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## **EXECUTIVE SUMMARY**

Year 2000 brought significant changes to the Joint Typhoon Warning Center (JTWC). In its second year of operations in Hawaii, JTWC had one of the easier forecasting seasons in the last two decades (based on the performance of the Climatology and Persistence (CLIPER) model, which provides a baseline against which to measure forecast skill). Still, operational feedback and some tropical cyclone (TC) events continue to demonstrate that the research and operational communities must work together to improve our ability to forecast significant changes in TC track and intensity.

In 1999, JTWC began using Tropical Rainfall Measurement Mission (TRMM) data operationally. In 2000, we began using QUIKSCAT. These new tools improved fixing capabilities and improved TC bogus input into models, and coupled with experienced forecasters, and JTWC's initial, beta use of the Systematic Approach Forecast Aid (SAFA), contributed to the best forecast year on record. However, forecast errors have still not reached the USCINCPAC goal of 50 nm (24 hours), 100 nm (48 hours) and 150 nm (72 hours), and individual storms such as TY 06W (Kaitak), STY 22W (Saomai), TY 29W (Yagi) and TY 34W (Soulik) presented significant forecast challenges, with either intricate tracks and/or rapid changes in intensity. Thus, we continue efforts to improve our track forecasting, and have begun efforts to baseline our intensity forecast capability. Improved dialogue and interaction with TC forecast support and research organizations such as the Fleet Numerical Meteorology and Oceanography Center, Naval Research Laboratory, Monterey, Naval Post Graduate School, and the Office of Naval Research about the development of numerical TC models and forecast aids, and the development of new techniques, such as our operational test and evaluation of Dr. Kerry Emanuel's Coupled Hurricane Intensity Program, will improve our ability to forecast these complicated scenarios.

JTWC is also seeking to develop and enhance working relationships with the World Meteorological Organization Regional Specialized Meteorological Centers and National Tropical Cyclone Warning Centers that exist throughout our area of responsibility. In developing these relationships, JTWC hopes to minimize forecast disparities, obtain better tropical cyclone forecast methods, and share knowledge and information. To that end, we recognize that our tropical cyclone data sets can be an integral part of the research and development effort for TC forecast improvement, and are in the process of improving the quality and accessibility of this data for research. As part of the 2000 ATCR, JTWC has reinstated Chapter 6, which describes some of our efforts toward product and data set improvement.

Behind all these efforts are people - the outstanding performers at JTWC, the Navy and Air Force personnel across the Pacific who support our reconnaissance and forecasting functions, the researchers and programmers helping develop our knowledge base and tool kit to better forecast tropical cyclones. Without an integrated effort, the challenging task of locating and forecasting the movement and structure of tropical cyclones would be considerably more difficult. That entire TC community will continue to focus all available science and technology on providing the best possible support to you, our customers, who stand in harms way.

## **FOREWARD**

The Annual Tropical Cyclone Report is prepared by the staff of the Joint Typhoon Warning Center (JTWC), a joint Navy/Air Force organization under the command of the Commanding Officer, Naval Pacific Meteorology and Oceanography Center/Joint Typhoon Warning Center (NPMOC/JTWC) located in Pearl Harbor, Hawaii. 2000 was the second year of operations for the JTWC in Hawaii after forty years on the island of Guam. With this relocation to Hawaii, all DOD tropical cyclone forecasting for the Pacific and Indian Oceans is now conducted out of one site by one organization headed by the Director, Joint Typhoon Warning Center.

The mission of JTWC as directed by USCINCPAC Instruction 3140.1W (series) is multifaceted and includes:

1. Continuous monitoring of all tropical weather activity in the Northern and Southern Hemispheres, from the west coast of the Americas to the east coast of Africa, and the prompt issuance of appropriate advisories and alerts when tropical cyclone development is anticipated.
2. Issuance of warnings on all significant tropical cyclones in the area of responsibility.
3. Determination of requirements for tropical cyclone reconnaissance and assignment of appropriate priorities.
4. Post-storm analysis of significant tropical cyclones occurring within the Western North Pacific and North Indian Oceans.

Special thanks are extended to the following organizations for their timely support of the JTWC mission:

Alternate Joint Typhoon Warning Center (NAVPCMETOCCEN Yokosuka)  
Fleet Numerical Meteorology and Oceanography Center  
Air Force Weather Agency  
NOAA Environmental Satellite Data and Information Service  
Naval Research Laboratory, Monterey  
Naval Postgraduate School

Of specific note, we would like to thank the following individuals:

Mr. Charles R. "Buck" Sampson and Ms. Ann Schrader, et al, for their constant support and continued development of the Automated Tropical Cyclone Forecasting System.

Dr. Lester E. Carr III, for continuing work on the Systematic and Integrated Approach to Tropical Cyclone Forecasting.

Mr. Jeff D. Hawkins, et al, for continuing efforts to exploit remote sensing technologies.

The men and women of the USPACOM tropical cyclone warning network, who participate in locating the tropical cyclone and help disseminate the tropical cyclone warning to the operational customer.

# 1. SUMMARY OF WESTERN NORTH PACIFIC AND NORTH INDIAN OCEAN TROPICAL CYCLONES

## 1.1 WESTERN NORTH PACIFIC OCEAN TROPICAL CYCLONES

Tropical cyclone genesis regions compared to the 15-year average are shown in Figure 1-1. This year's tropical cyclones are listed in Table 1-1. Table 1-2 shows the monthly distribution of tropical cyclones for each year since 1959 and Table 1-3 shows the monthly average occurrence of tropical storms separated into: (1) typhoons only; and (2) tropical storms and typhoons. A summary of this year's Tropical Cyclone Formation Alerts is shown in Table 1-4. The annual number of tropical cyclones of tropical storm strength and higher appear in Figure 1-2, while the number of super typhoons are shown in Figure 1-3. Composites of the tropical cyclone best tracks for the western North Pacific appear following Figure 1-3.

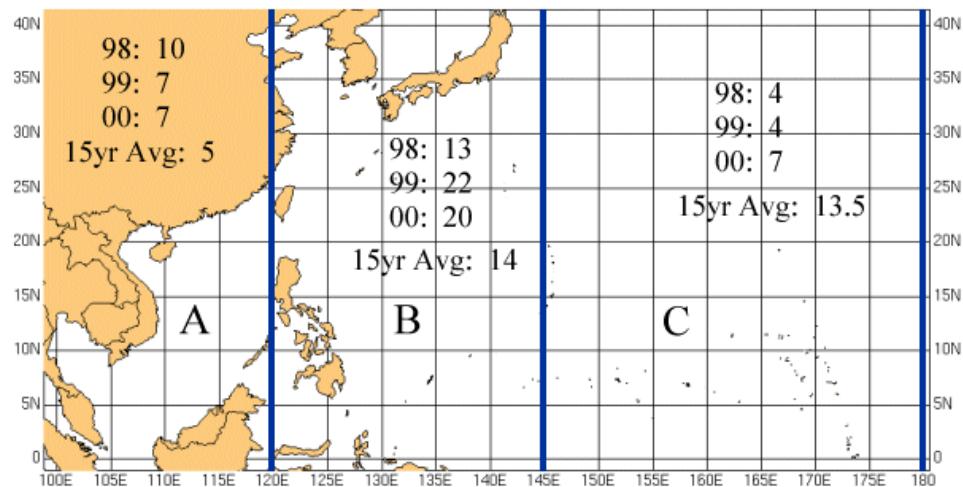


Figure 1-1. Comparison of the number of tropical cyclones that developed within 3 designated areas for 1998, 1999, 2000, and the 15-year average.

Table 1-1 WESTERN NORTH PACIFIC SIGNIFICANT TROPICAL CYCLONES FOR 2000 (01 JAN 2000 - 31 DEC 2000)

TC	NAME	PERIOD	WARNINGS ISSUED	EST MAX WINDS KTS (M/SEC)	MSLP (MB)**
STY 01W	(DAMREY)	05 May 12 May	27	155 (79)	878
TS 02W	(LONGWANG)	18 May 20 May	7	45 (23)	991
TD 03W	-	21 May 22 May	5	30 (15)	1000
TD 04W	-	30 May 01 Jun	8	30 (15)	1000
TY 05W	(KIROGI)	02 Jul 08 Jul	27	115 (59)	927
TY 06W	(KAI-TAK)	04 Jul 11 Jul	28	75 (39)	967
TD 07W	-	13 Jul 15 Jul	9	30 (15)	1000
TD 08W	-	16 Jul 17 Jul	7	25 (13)	1002
TS 09W	(TEMBIN)	17 Jul 23 Jul	22	45 (23)	991
TD 10W	-	20 Jul 22 Jul	13	25 (13)	1002
TS 11W	(BOLAVEN)	24 Jul 31 Jul	27	50 (26)	987
TS 12W	(CHANCHU)	28 Jul 29 Jul	8	35 (18)	994
TY 13W	(JELAWAT)	01 Aug 11 Aug	42	125 (64)	916
TD 14W	-	08 Aug 10 Aug	8	30 (15)	1000
TY 15W	(EWINIAR)	09 Aug 19 Aug	41	75 (39)	967
TS 16W	(WENE)	15 Aug 17 Aug	3 (6)*	55 (28)	984
TD 17W	-	17 Aug 19 Aug	6	25 (13)	1002
STY 18W	(BILIS)	18 Aug 24 Aug	24	140 (72)	898
TS 19W	(KAEMI)	20 Aug 23 Aug	12	45 (23)	991
TY 20W	(PRAPIROON)	26 Aug 01 Sep	26	75 (39)	967
TS 21W	(MARIA)	28 Aug 01 Sep	17	55 (28)	984
STY 22W	(SAOMAI)	02 Sep 16 Sep	56	140 (72)	898
TY 23W	(WUKONG)	05 Sep 10 Sep	21	95 (49)	949
TS 24W	(BOPHA)	05 Sep 12 Sep	26	55 (28)	984
TY 25W	(SONAMU)	14 Sep 18 Sep	16	75 (39)	967
STY 26W	(SHANSHAN)	17 Sep 24 Sep	28	130 (67)	910
TD 27W	-	28 Sep 30 Sep	7	30 (15)	1000
TS 28W	-	06 Oct 13 Oct	27	40 (21)	994
TY 29W	(YAGI)	21 Oct 28 Oct	27	105 (54)	938
TY 30W	(XANGSANE)	25 Oct 01 Nov	30	90 (46)	954
TY 31W	(BEBINCA)	31 Oct 08 Nov	33	85 (44)	958
TD 32W	-	08 Nov 09 Nov	8	30 (15)	1000
TS 33W	(RUMBIA)	28 Nov 08 Dec	36	50 (26)	987
TY 34W	(SOULIK)	29 Dec 05 Jan 2001	29	110 (57)	933
	JTWC TOTAL		711		
	( )NPMOC TOTAL		6		
	GRAND TOTAL		717		

\*WARNINGS ISSUED BY NPMOC

\*\*MSLP Converted from estimated maximum surface winds using Atkinson/Holiday wind-pressure relationship

Table 1-2 DISTRIBUTION OF WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959 - 2000

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
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Table 1-2 DISTRIBUTION OF WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959 - 2000

1959	0	1	1	1	0	1	3	8	9	3	2	2	31
	000	010	010	100	000	001	111	512	423	210	200	200	17 7 7
1960	1	0	1	1	1	3	3	9	5	4	1	1	30
	001	000	001	100	010	210	210	810	041	400	100	100	19 8 3
1961	1	1	1	1	4	6	5	7	6	7	2	1	42
	010	010	100	010	211	114	320	313	510	322	101	100	20 11 11
1962	0	1	0	1	3	0	8	8	7	5	4	2	39
	000	010	000	100	201	000	512	701	313	311	301	020	24 6 9
1963	0	0	1	1	0	4	5	4	4	6	0	3	28
	000	000	001	100	000	310	311	301	220	510	000	210	19 6 3
1964	0	0	0	0	3	2	8	8	8	7	6	2	44
	000	000	000	000	201	200	611	350	521	331	420	101	26 13 5
1965	2	2	1	1	2	4	6	7	9	3	2	1	40
	110	020	010	100	101	310	411	322	531	201	110	010	21 13 6
1966	0	0	0	1	2	1	4	9	10	4	5	2	38
	000	000	000	100	200	100	310	531	532	112	122	101	20 10 8
1967	1	0	2	1	1	1	8	10	8	4	4	1	41
	010	000	110	100	010	100	332	343	530	211	400	010	20 15 6
1968	0	1	0	1	0	4	3	8	4	6	4	0	31
	000	001	000	100	000	202	120	341	400	510	400	000	20 7 4
1969	1	0	1	1	0	0	3	3	6	5	2	1	23
	100	000	010	100	000	000	210	210	204	410	110	010	13 6 4
1970	0	1	0	0	0	2	3	7	4	6	4	0	27
	000	100	000	000	000	110	021	421	220	321	130	000	12 12 3
1971	1	0	1	2	5	2	8	5	7	4	2	0	37
	010	000	010	200	230	200	620	311	511	310	110	000	24 11 2
1972	1	0	1	0	0	4	5	5	6	5	2	3	32
	100	000	001	000	000	220	410	320	411	410	200	210	22 8 2
1973	0	0	0	0	0	0	7	6	3	4	3	0	23
	000	000	000	000	000	000	430	231	201	400	030	000	12 9 2
1974	1	0	1	1	1	4	5	7	5	4	4	2	35
	010	000	010	010	100	121	230	232	320	400	220	020	15 17 3
1975	1	0	0	1	0	0	1	6	5	6	3	2	25
	100	000	000	001	000	000	010	411	410	321	210	002	14 6 5
1976	1	1	0	2	2	2	4	4	5	0	2	2	25
	100	010	000	110	200	200	220	130	410	000	110	020	14 11 0
1977	0	0	1	0	1	1	4	2	5	4	2	1	21
	000	000	010	000	001	010	301	020	230	310	200	100	11 8 2
1978	1	0	0	1	0	3	4	8	4	7	4	0	32
	010	000	000	100	000	030	310	341	310	412	121	000	15 13 4
1979	1	0	1	1	2	0	5	4	6	3	2	3	28
	100	000	100	100	011	000	221	202	330	210	110	111	14 9 5
1980	0	0	1	1	4	1	5	3	7	4	1	1	28
	000	000	001	010	220	010	311	201	511	220	100	010	15 9 4
1981	0	0	1	1	1	2	5	8	4	2	3	2	29
	000	000	100	010	010	200	230	251	400	110	210	200	16 12 1

Table 1-2 DISTRIBUTION OF WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959 - 2000

1982	0	0	3	0	1	3	4	5	6	4	1	1	28
	000	000	210	000	100	120	220	500	321	301	100	100	19 7 2
1983	0	0	0	0	0	1	3	6	3	5	5	2	25
	000	000	000	000	000	010	300	231	111	320	320	020	12 11 2
1984	0	0	0	0	0	2	5	7	4	8	3	1	30
	000	000	000	000	000	020	410	232	130	521	300	100	16 11 3
1985	2	0	0	0	1	3	1	7	5	5	1	2	27
	020	000	000	000	100	201	100	520	320	410	010	110	17 9 1
1986	0	1	0	1	2	2	2	5	2	5	4	3	27
	000	100	000	100	110	110	200	410	200	320	220	210	19 8 0
1987	1	0	0	1	0	2	4	4	7	2	3	1	25
	100	000	000	010	000	110	400	310	511	200	120	100	18 6 1
1988	1	0	0	0	1	3	2	5	8	4	2	1	27
	100	000	000	000	100	111	110	230	260	400	200	010	14 12 1
1989	1	0	0	1	2	2	6	8	4	6	3	2	35
	010	000	000	100	200	110	231	332	220	600	300	101	21 10 4
1990	1	0	0	1	2	4	4	5	5	5	4	1	32
	100	000	000	010	110	211	220	500	410	230	310	100	21 10 1
1991	0	0	2	1	1	1	4	8	6	3	6	0	32
	000	000	110	010	100	100	400	332	420	300	330	000	20 10 2
1992	1	1	0	0	0	3	4	8	5	6	5	0	33
	100	010	000	000	000	210	220	440	410	510	311	000	21 11 1
1993	0	0	2	2	1	2	5	8	5	6	4	3	38
	000	000	011	002	010	101	320	611	410	321	112	300	21 9 8
1994	1	0	1	0	2	2	9	9	8	7	0	2	41
	001	000	100	000	101	020	342	630	440	511	000	110	21 15 5
1995	1	0	0	0	1	2	3	7	7	8	2	3	34
	001	000	000	000	010	020	210	421	412	512	020	012	15 11 8
1996	0	1	0	2	2	0	7	10	7	5	6	3	43
	000	001	000	011	110	000	610	433	610	212	132	111	21 12 10
1997*	1	0	0	2	3	3	4	8	4	6	1	1	33
	010	000	000	110	120	300	310	611	310	411	100	100	23 8 2
1998*	0	0	0	0	0	0	3	3	8	6	3	4	27
	000	000	000	000	000	000	012	210	413	213	030	112	9 8 10
1999*	1	1	0	3	0	1	5	9	6	2	3	3	34
	010	010	000	210	000	100	113	423	240	110	111	003	12 12 10
2000	0	0	0	0	4	0	8	9	6	3	3	1	34
	000	000	000	000	112	000	233	432	411	210	111	100	15 10 9
(1959-2000)													
MEAN	0.6	0.3	0.5	0.8	1.3	2.0	4.6	6.6	5.8	4.7	2.9	1.6	31.8
CASES	24	12	23	34	55	83	195	277	243	199	123	66	1334

The criteria used in TABLE 1-2 are as follows:

1) If a tropical cyclone was first warned on during the last two days of a particular month and continued into the next month for longer than two days, then that system was attributed to the second month.

2) If a tropical cyclone was warned on prior to the last two days of a month, it was attributed to the first month, regardless of how long the system lasted.

Table 1-2 DISTRIBUTION OF WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959 - 2000

3) If a tropical cyclone began on the last day of the month and ended on the first day of the next month, that system was attributed to the first month. However, if a tropical cyclone began on the last day of the month and continued into the next month for only two days, then it was attributed to the second month.

\* Errors in this table have been noted for the years 1997, 1998 and 1999 in previous ATCRs. The current table has been updated to reflect the correct data.

TABLE 1-3 WESTERN NORTH PACIFIC TROPICAL CYCLONES

TYPHOONS (1945-1959)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
MEAN	0.3	0.1	0.3	0.4	0.7	1	2.9	3.1	3.3	2.4	2	0.9	16.4
CASES	5	1	4	6	10	15	29	46	49	36	30	14	245

TYPHOONS (1960-2000)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
MEAN	0.2	0.0	0.2	0.4	0.7	1.0	2.7	3.5	3.4	3.1	1.6	0.7	17.6
CASES	10	2	8	18	28	42	110	142	139	129	65	28	721

TROPICAL STORMS AND TYPHOONS (1945-1959)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
MEAN	0.4	0.1	0.5	0.5	0.8	1.6	2.9	4	4.2	3.3	2.7	1.2	22.2
CASES	6	2	7	8	11	22	44	60	64	49	41	18	332

TROPICAL STORMS AND TYPHOONS (1960-2000)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTALS
MEAN	0.5	0.2	0.4	0.7	1.1	1.7	4.1	5.6	5.1	4.2	2.7	1.2	27.6
CASES	21	9	17	29	46	71	170	228	210	172	109	50	1132

TABLE 1-4 TROPICAL CYCLONE FORMATION ALERTS FOR THE WESTERN NORTH PACIFIC OCEAN FOR 1976-2000

YEAR	INITIAL TC- FAS	TROPICAL CY- CLONES WITH TCFAS	TOTAL TROP- ICAL CY- CLONES	PROBABILITY OF WITHOUT WARNING*	PROBABILITY OF TCFA BEFORE WARNING
1976	34	25	25	26%	100%
1977	26	20	21	23%	95%
1978	32	27	32	16%	84%
1979	27	23	28	15%	82%
1980	37	28	28	24%	100%
1981	29	28	29	3%	96%
1982	36	26	28	28%	93%
1983	31	25	25	19%	100%
1984	37	30	30	19%	100%
1985	39	26	27	33%	96%
1986	38	27	27	29%	100%
1987	31	24	25	23%	96%
1988	33	26	27	21%	96%
1989	51	32	35	37%	91%
1990	33	30	31	9%	97%

TABLE 1-4 TROPICAL CYCLONE FORMATION ALERTS FOR THE WESTERN NORTH PACIFIC OCEAN FOR 1976-2000

1991	37	29	31	22%	94%
1992	36	32	32	11%	100%
1993	50	35	38	30%	92%
1994	50	40	40	20%	100%
1995	54	33	35	39%	94%
1996	41	39	43	,5%	91%
1997	36	30	33	17%	91%
1998	38	18	27	53%	67%
1999	39	29	33	26%	88%
2000	40	31	34	23%	91%
(1976-2000)					
MEAN:	37.4	28.5	30.6	23.7%	93.3%
TOTALS:	935	713	764		

\* Percentage of initial TCFAs not followed by warnings.

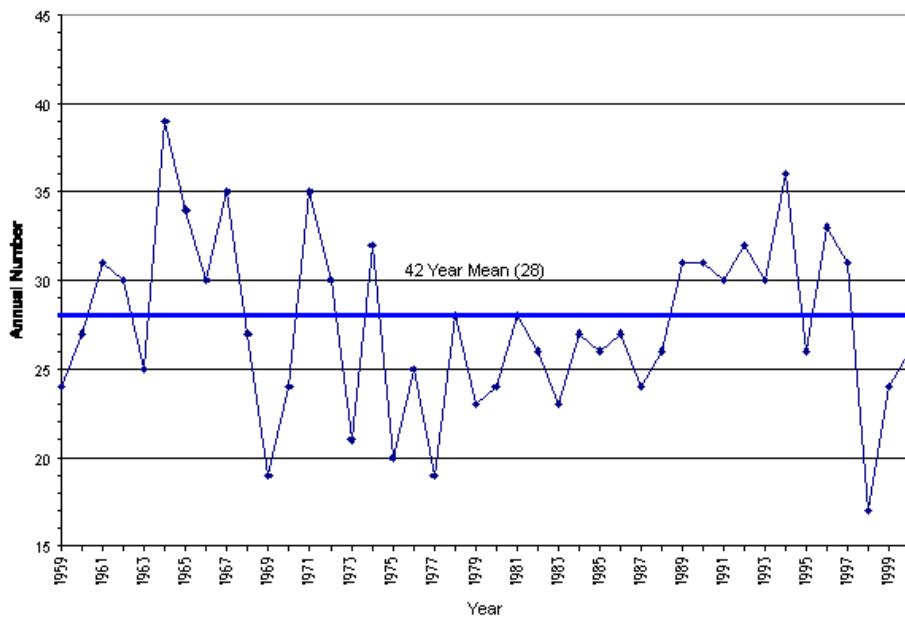


Figure 1-2. Tropical cyclones of tropical storm or greater intensity in the western North Pacific (1959-2000).

## 1.2 NORTH INDIAN OCEAN TROPICAL CYCLONES

This year's North Indian Ocean tropical cyclones are listed in Table 1-5. The monthly distribution of tropical cyclones for each year since 1975 is shown in Table 1-6. Composites of the tropical cyclone best tracks for the Northern Indian Ocean appear following Table 1-6.

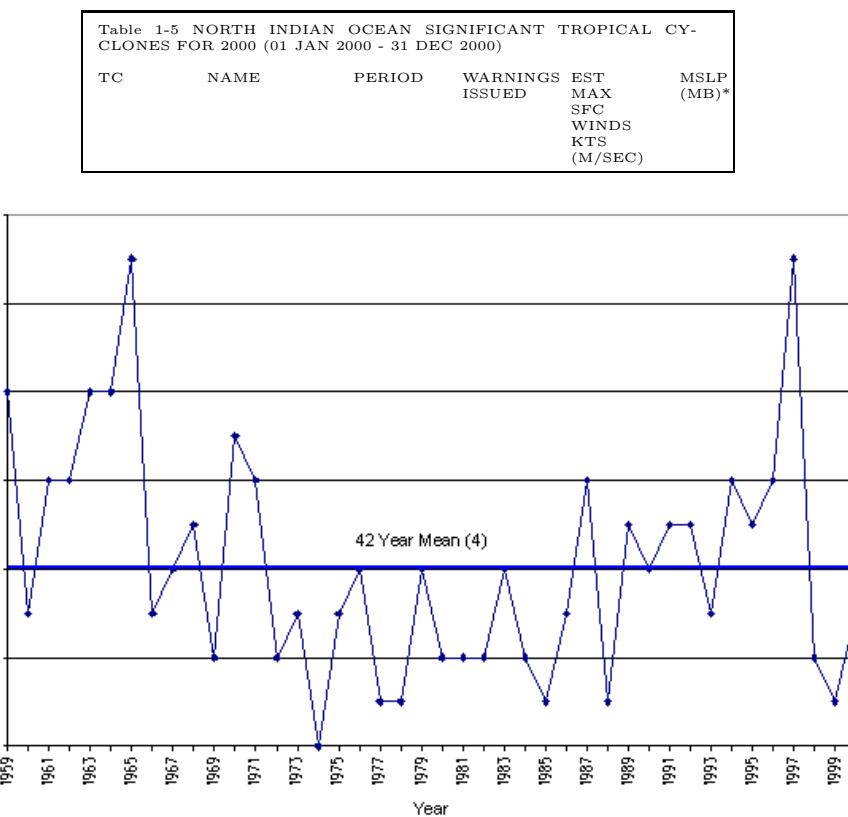


Figure 1-3. Number of western North Pacific super typhoons (1959-2000).

Table 1-5 NORTH INDIAN OCEAN SIGNIFICANT TROPICAL CYCLONES FOR 2000 (01 JAN 2000 - 31 DEC 2000)						
01B	-	16 Oct - 18 Oct	6	35 (18)	997	
02B	-	27 Oct - 28 Oct	2	35 (18)	997	
03B	-	26 Nov - 05 Dec	16	75 (39)	967	
04B	-	25 Dec - 28 Dec	7	60 (31)	980	
				JTWC Total	31	

\*MSLP Converted from estimated maximum surface winds using Atkinson/Holiday wind-pressure relationship

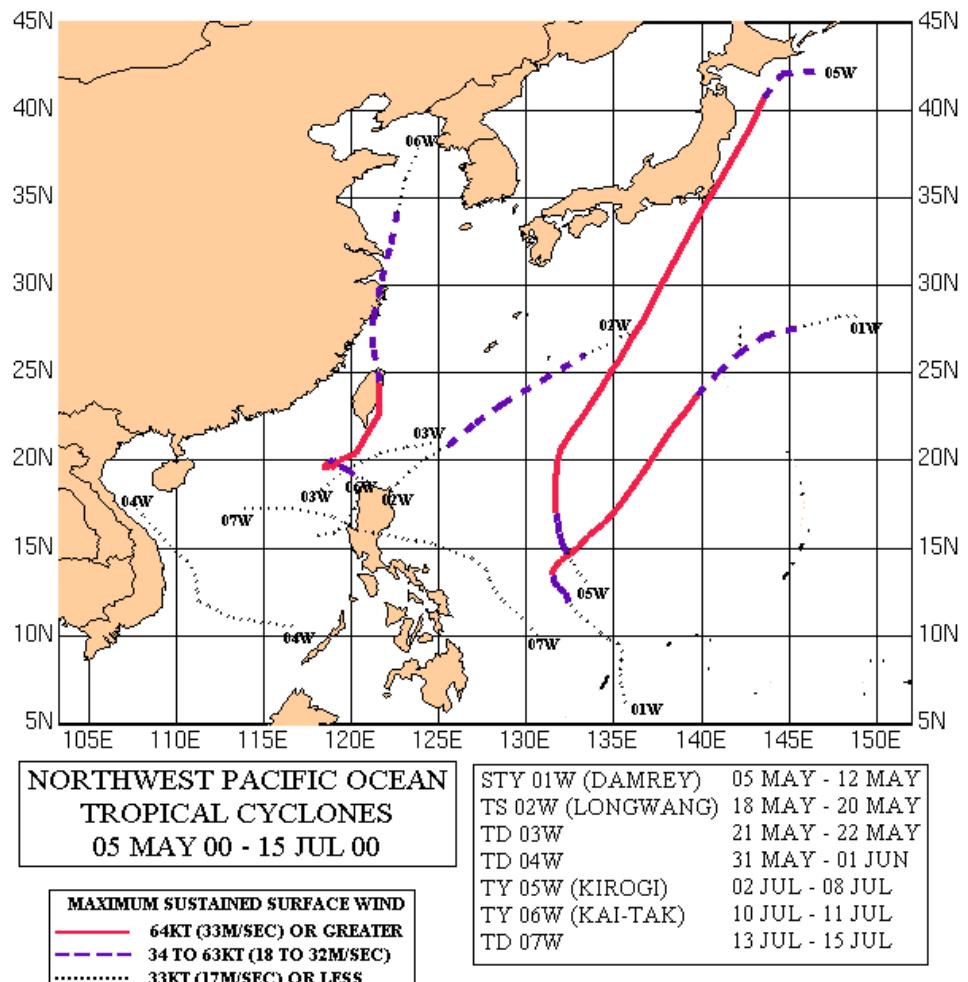
YEAR	Table 1-6 DISTRIBUTION OF NORTHERN INDIAN OCEAN TROPICAL CYCLONES FOR 1975 - 2000												TOTALS
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
1975	1	0	0	0	2	0	0	0	0	1	2	0	6
	0 1 0	0 0 0	0 0 0	0 0 0	2 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 2 0	0 0 0	3 3 0
1976	0	0	0	1	0	1	0	0	1	1	0	1	5
	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0 1 0	0 0 0	0 0 0	0 1 0	0 1 0	0 0 0	0 1 0	0 5 0
1977	0	0	0	0	1	1	0	0	0	1	0	2	5
	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 1 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	1 1 0	1 4 0
1978	0	0	0	0	1	0	0	0	0	1	2	0	4
	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	2 0 0	0 0 0	2 2 0
1979	0	0	0	0	1	1	0	0	2	1	2	0	7
	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 1 0	0 0 0	0 0 0	0 1 1	0 1 0	0 1 1	0 0 0	1 4 2
1980	0	0	0	0	0	0	0	0	0	0	1	1	2
	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 1 0	0 2 0
1981	0	0	0	0	0	0	0	0	1	0	1	1	3
	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	1 0 0	1 0 0	2 1 0
1982	0	0	0	0	1	1	0	0	0	2	1	0	5
	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 1 0	0 0 0	0 0 0	0 0 0	0 2 0	1 0 0	0 0 0	2 3 0
1983	0	0	0	0	0	0	0	1	0	1	1	0	3
	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0 1 0	0 1 0	0 0 0	0 3 0
1984	0	0	0	0	1	0	0	0	0	1	2	0	4
	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	2 0 0	0 0 0	2 2 0
1985	0	0	0	0	2	0	0	0	0	2	1	1	6
	0 0 0	0 0 0	0 0 0	0 0 0	0 2 0	0 0 0	0 0 0	0 0 0	0 0 0	0 2 0	0 1 0	0 1 0	0 6 0
1986	1	0	0	0	0	0	0	0	0	0	2	0	3
	0 1 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 2 0	0 0 0	0 3 0
1987	0	1	0	0	0	2	0	0	0	2	1	2	8
	0 0 0	0 1 0	0 0 0	0 0 0	0 0 0	0 2 0	0 0 0	0 0 0	0 0 0	0 2 0	0 1 0	0 2 0	0 8 0
1988	0	0	0	0	0	1	0	0	0	1	2	1	5
	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 0 0	0 0 0	0 0 0	0 1 0	1 1 0	0 1 0	1 4 0
1989	0	0	0	0	1	1	0	0	0	0	1	0	3
	0 0 0	0 0 0	0 0 0	0 0 0	0 1 0	0 1 0	0 0 0	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	1 2 0
1990	0	0	0	1	1	0	0	0	0	0	1	1	4
	0 0 0	0 0 0	0 0 0	0 0 1	1 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 1	0 1 0	1 1 2

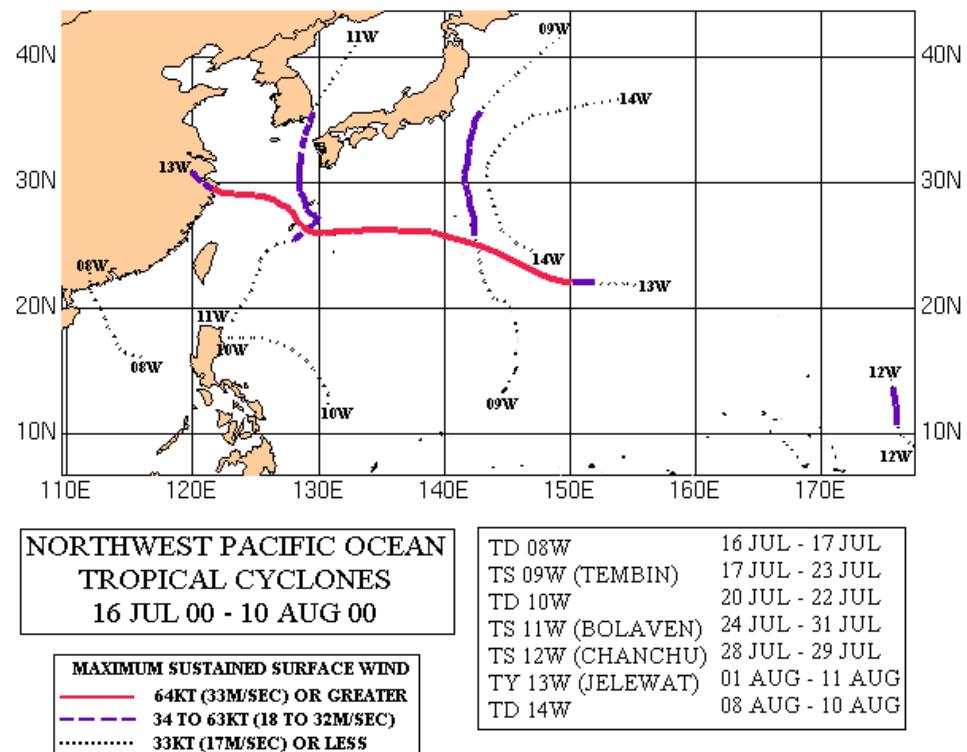
Table 1-6 DISTRIBUTION OF NORTHERN INDIAN OCEAN TROPICAL CYCLONES FOR 1975 - 2000

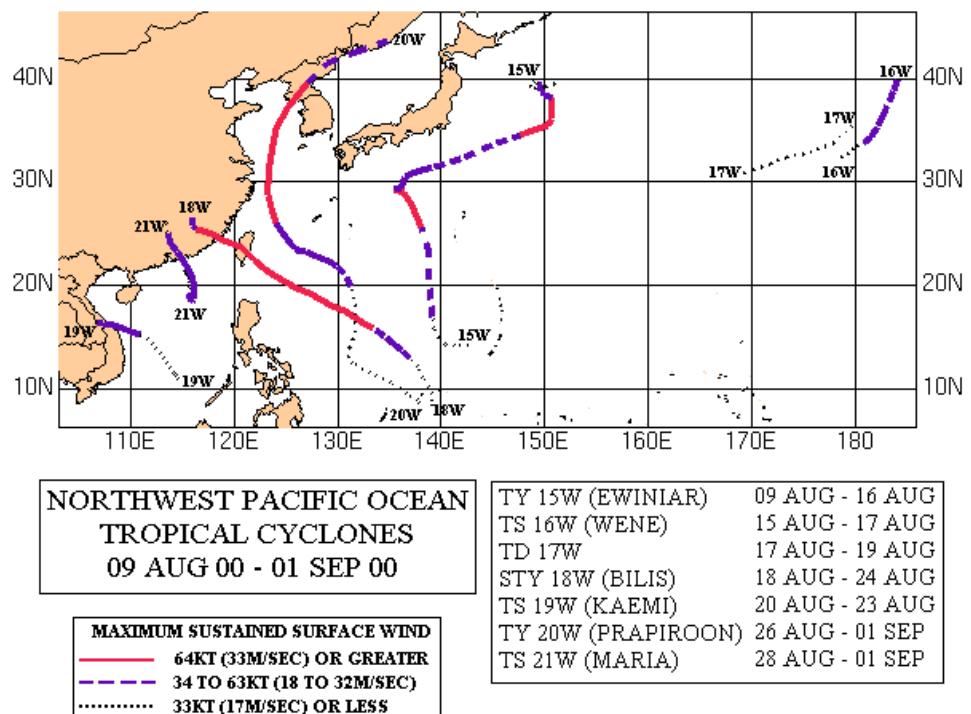
1991	1	0	0	1	0	1	0	0	0	0	0	1	0	4
	0	1	0	0	0	0	0	0	0	0	0	1	0	220
1992	0	0	0	0	1	2	1	0	1	3	3	2	13	
	0	0	0	0	0	0	0	0	0	0	0	2	10	382
1993	0	0	0	0	0	0	0	0	0	0	0	2	0	2
	0	0	0	0	0	0	0	0	0	0	0	2	0	200
1994	0	0	1	1	0	1	0	0	0	1	1	0	5	
	0	0	0	0	1	0	1	0	0	1	0	1	0	140
1995	0	0	0	0	0	0	0	0	1	1	2	0	4	
	0	0	0	0	0	0	0	0	1	0	1	0	0	220
1996	0	0	0	0	1	3	0	0	0	2	2	0	8	
	0	0	0	0	0	0	1	2	0	0	0	0	0	440
1997	0	0	0	0	1	0	0	0	1	1	1	0	4	
	0	0	0	0	0	0	1	0	0	1	0	1	0	220
1998	0	0	0	0	2	1	0	0	1	1	2	1	8	
	0	0	0	0	0	0	1	0	1	0	1	0	0	530
1999	0	1	0	0	1	1	0	0	0	2	0	0	5	
	0	0	0	1	0	0	0	0	0	2	0	0	0	320
2000	0	0	0	0	0	0	0	0	0	2	1	1	4	
	0	0	0	0	0	0	0	0	0	2	0	1	0	130
(1959-2000)														
MEAN	0.1	0.1	0.0	0.2	0.7	0.7	0.0	0.0	0.3	1.0	1.3	0.5	5.0	
CASES	3	2	1	4	17	17	1	1	8	27	35	14	130	

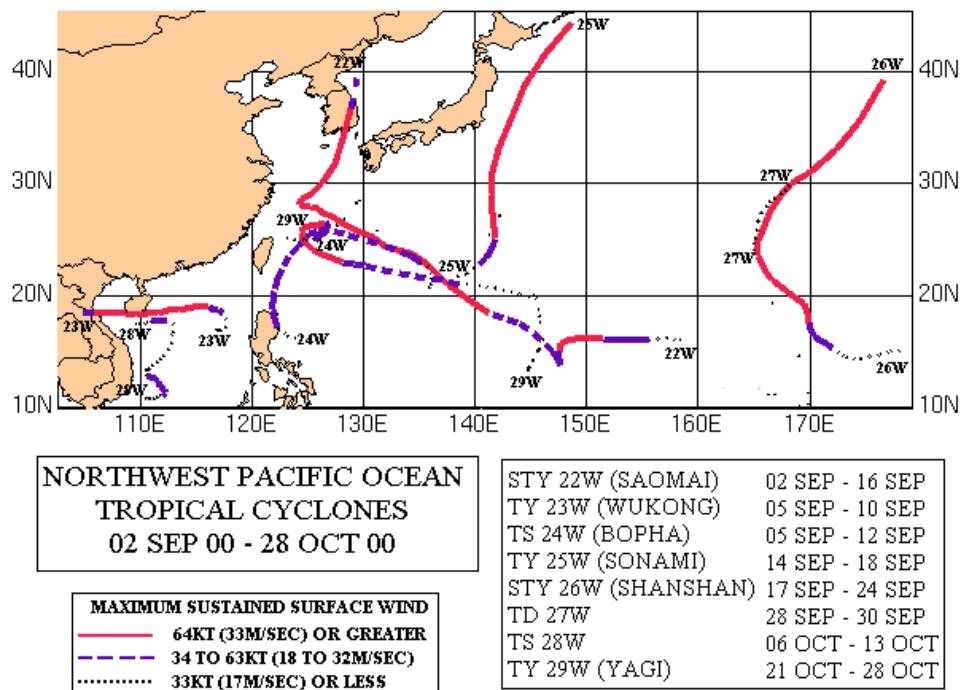
The criteria used in TABLE 1-6 are as follows:

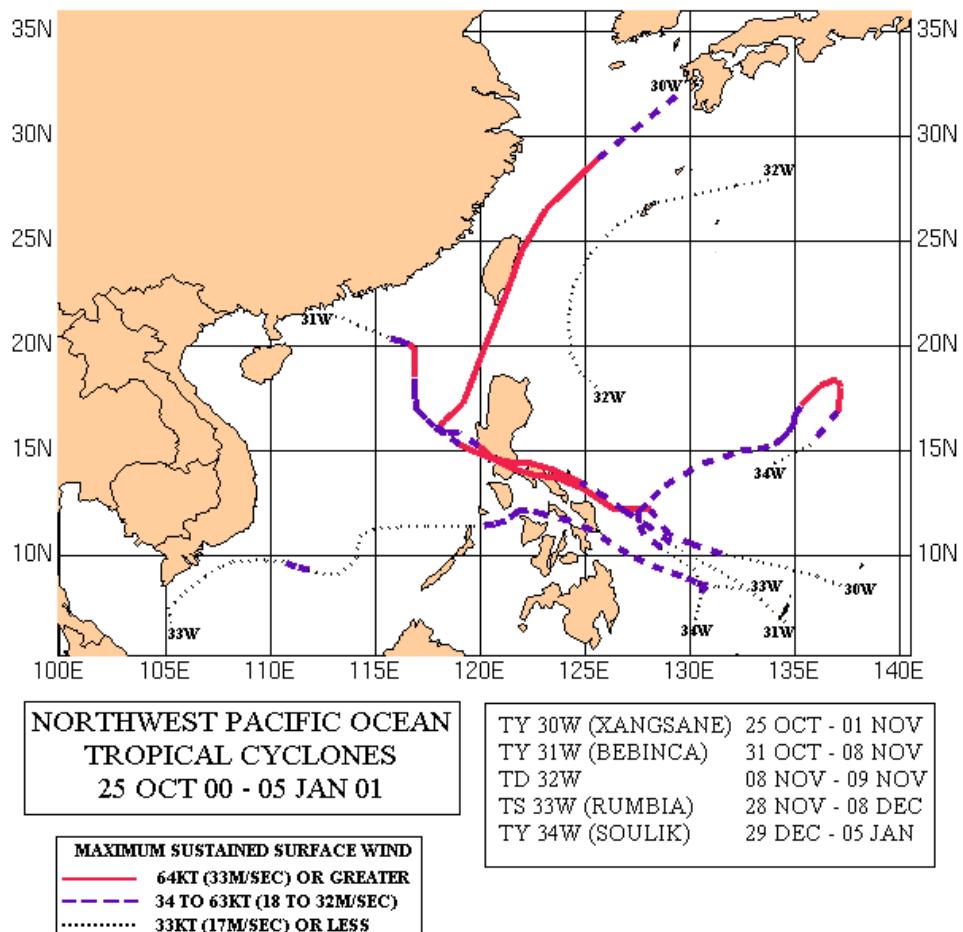
- 1) If a tropical cyclone was first warned on during the last two days of a particular month and continued into the next month for longer than two days, then that system was attributed to the second month.
- 2) If a tropical cyclone was warned on prior to the last two days of a month, it was attributed to the first month, regardless of how long the system lasted.
- 3) If a tropical cyclone began on the last day of the month and ended on the first day of the next month, that system was attributed to the first month. However, if a tropical cyclone began on the last day of the month and continued into the next month for only two days, then it was attributed to the second month.

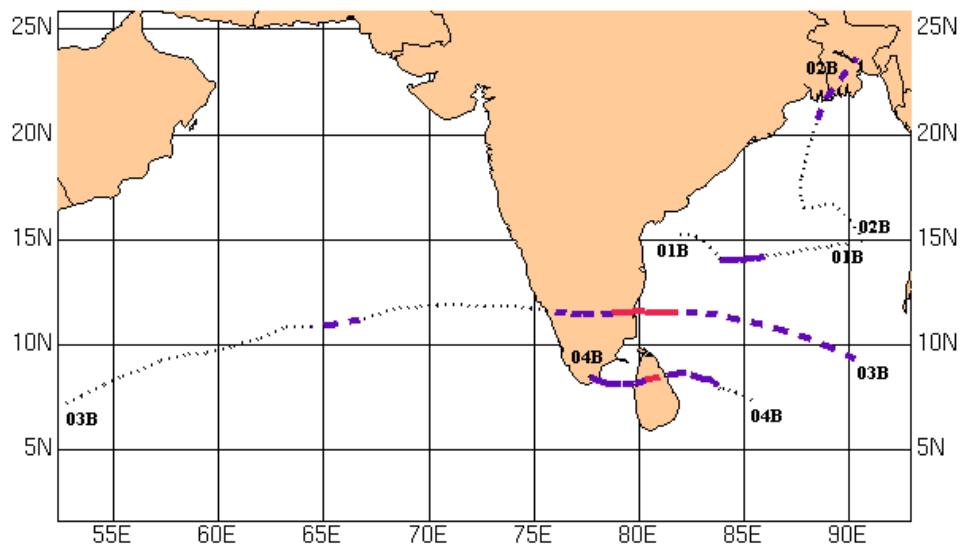












**NORTH INDIAN OCEAN  
TROPICAL CYCLONES  
16 OCT 00 - 28 DEC 00**

TC 01B 16 OCT 00 - 18 OCT 00  
TC 02B 27 OCT 00 - 28 OCT 00  
TC 03B 26 NOV 00 - 05 DEC 00  
TC 04B 25 DEC 00 - 28 DEC 00

**MAXIMUM SUSTAINED SURFACE WIND**  
 ————— 64KT (33M/SEC) OR GREATER  
 - - - - - 34 TO 63KT (18 TO 32M/SEC)  
 ..... 33KT (17M/SEC) OR LESS

# **Super Typhoon (STY) 01W (Damrey\*)**

First Poor : 1400Z 03 May 00

First Fair : 1700Z 03 May 00

First TCFA : 2330Z 04 May 00

First Warning : 1800Z 05 May 00

Last Warning : 0600Z 12 May 00

Max Intensity : 155 kts, Gusts to 190 kts

Landfall : None

Total Warnings : 27

Remarks:

- (1) First tropical cyclone for 2000 and first super typhoon that occurred during the western North Pacific Ocean tropical cyclone season.
- (2) The second most intense tropical cyclone to have occurred in May according to JTWC records.
- (3) Rapidly intensified to super typhoon strength after changing track from northwestward to northeastward in the Philippine Sea.
- (4) Reached peak intensity 091800Z May 00
- (5) Weakened to tropical storm intensity 30 hours after attaining peak intensity.
- (6) Experienced vertical shear, weakened then dissipated near the Bonin Islands.

\* Name assigned by RSMC Tokyo

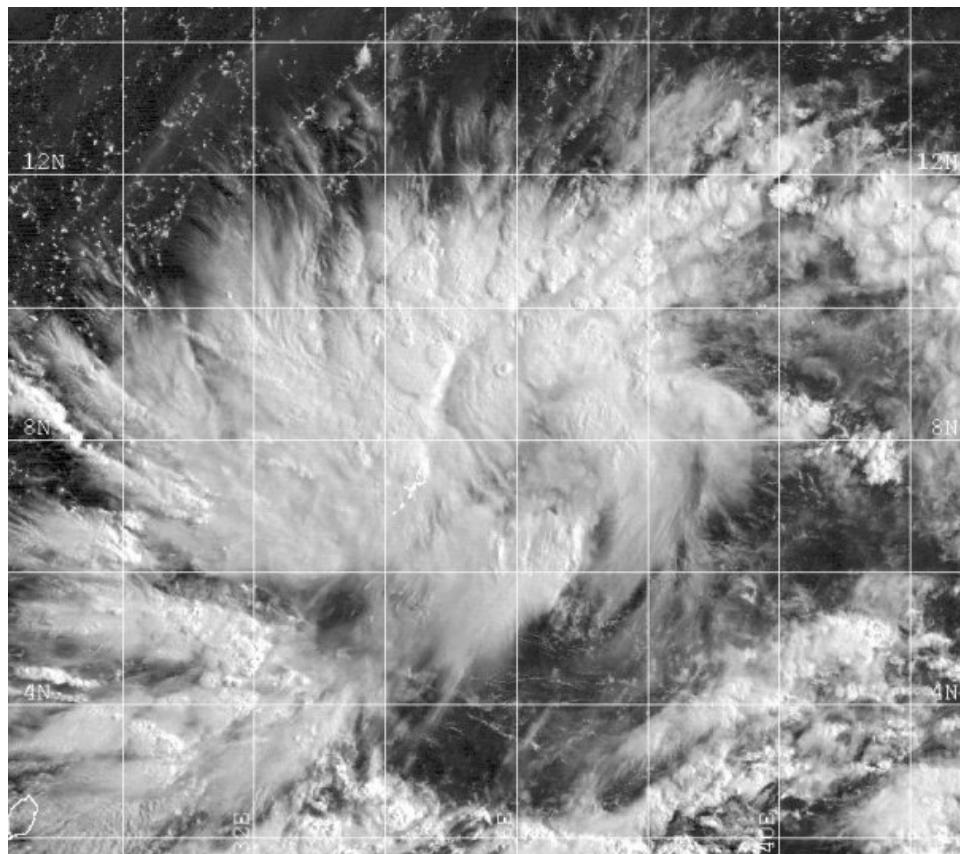


Figure 1-01W-1. 0323Z May 2000 GMS-5 visible image of the incipient disturbance near Palau which developed into STY 01W.

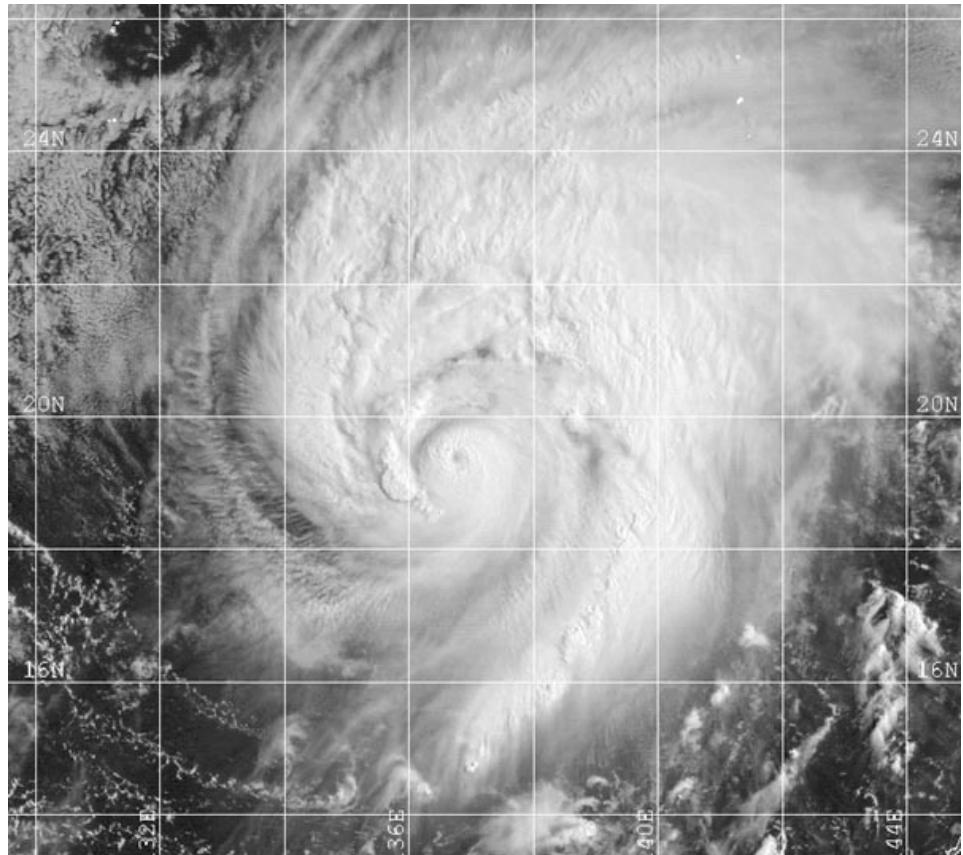


Figure 1-01W-2. 092301Z May 2000 GMS-5 visible image of STY 01W near peak intensity, with estimated winds of 150 knots. At this time, STY 01W is located about 480 nm west of the Mariana Islands with a tiny eye embedded within a well developed central dense overcast.

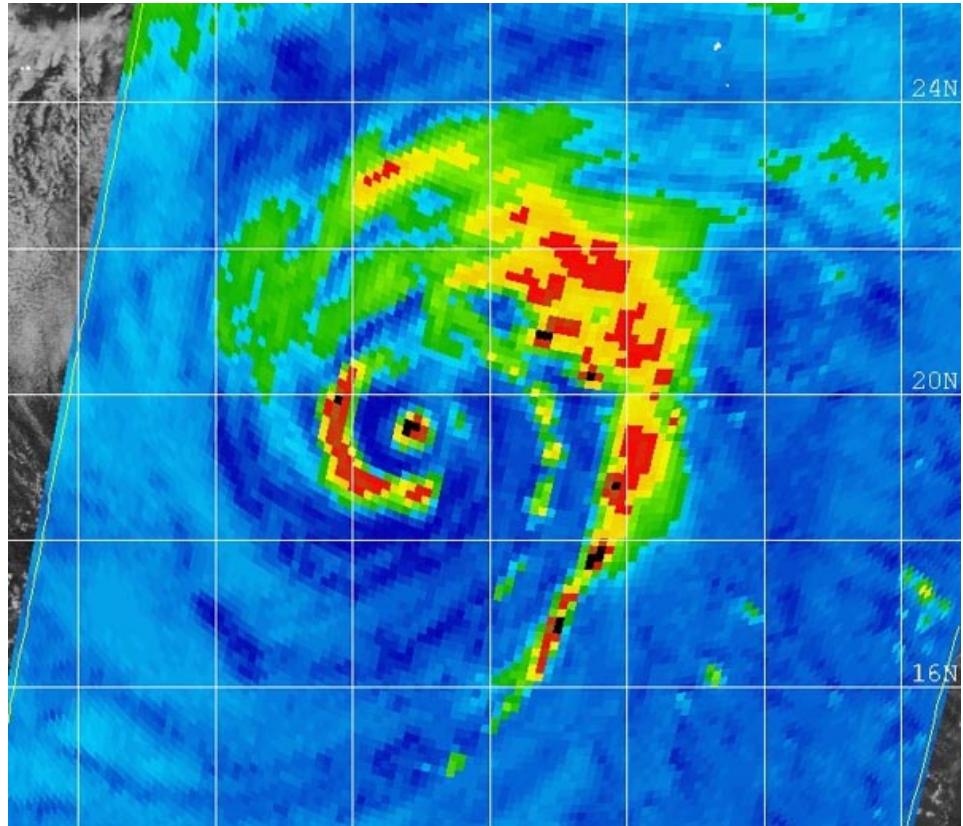


Figure 1-01W-3. 092342Z May 2000 SSMI 85 GHz image of STY 01W, with well-developed convection to the northeast of the low-level circulation.

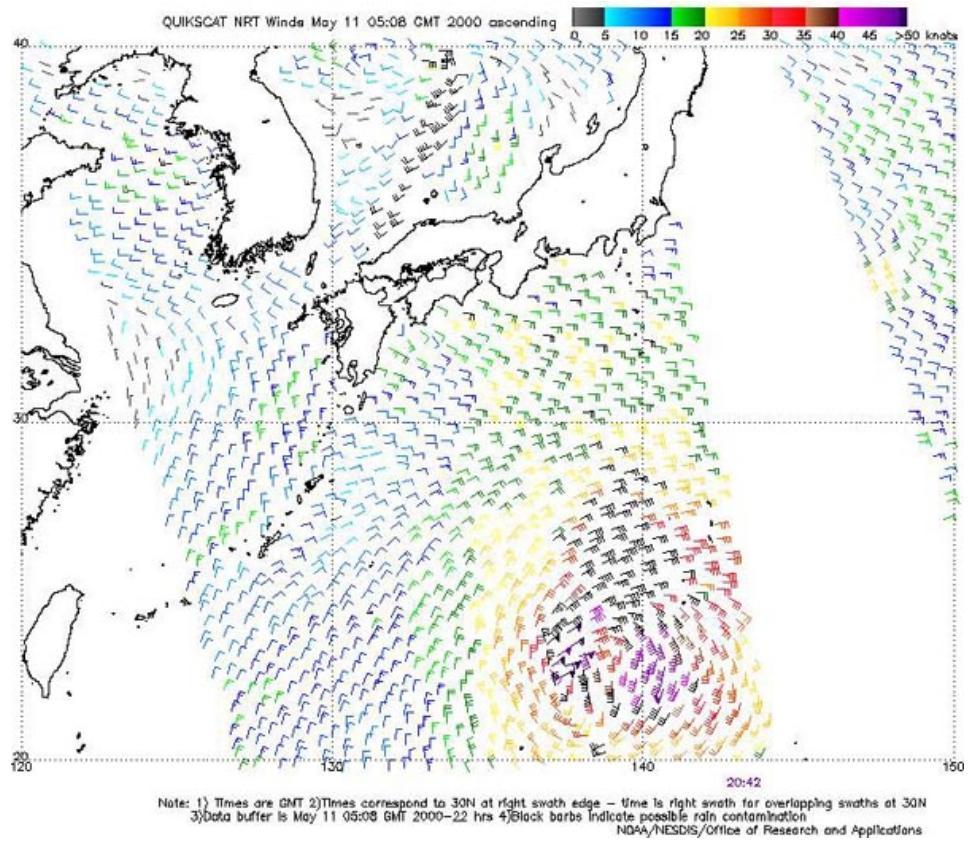


Figure 1-01W-4. 110508Z May 2000 QUIKSCAT pass over the well-defined low-level circulation center. STY 01W is centered 10 degrees south of Japan, with estimated best track intensity of 45 knots.

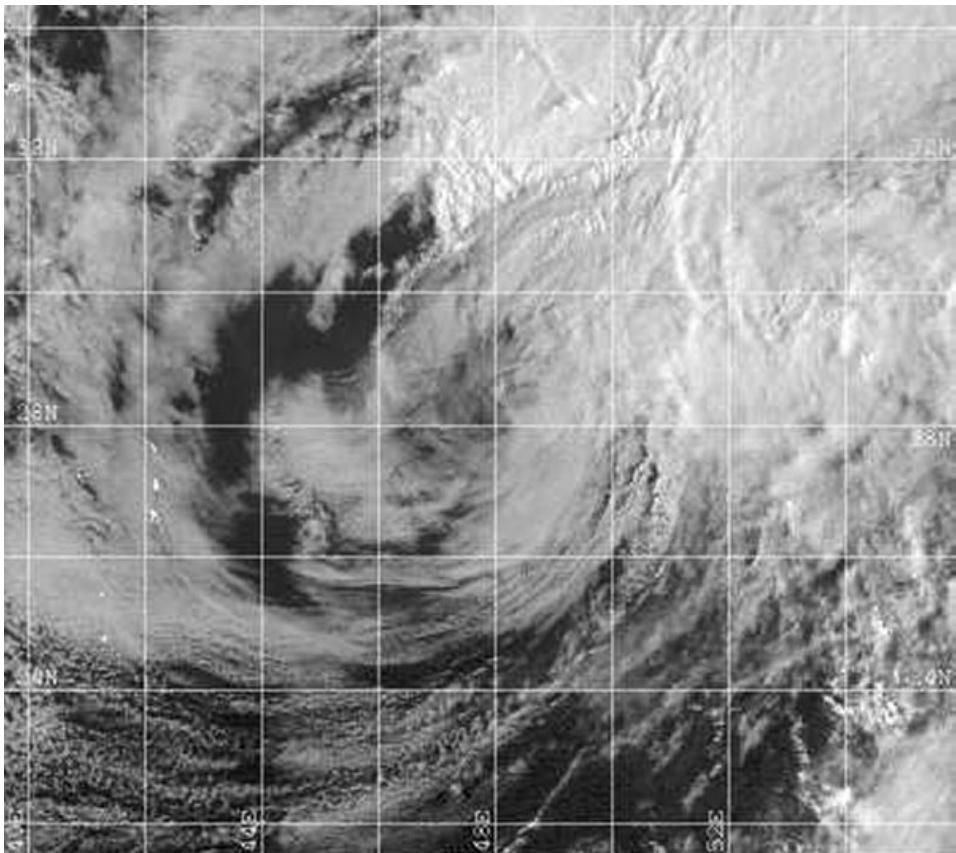
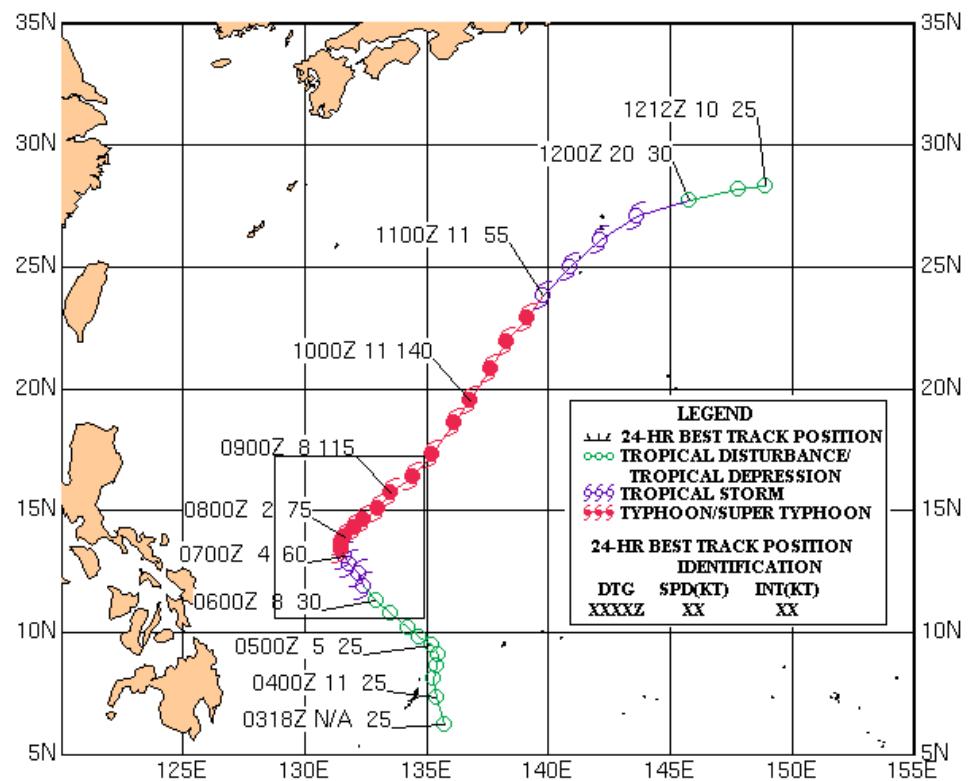
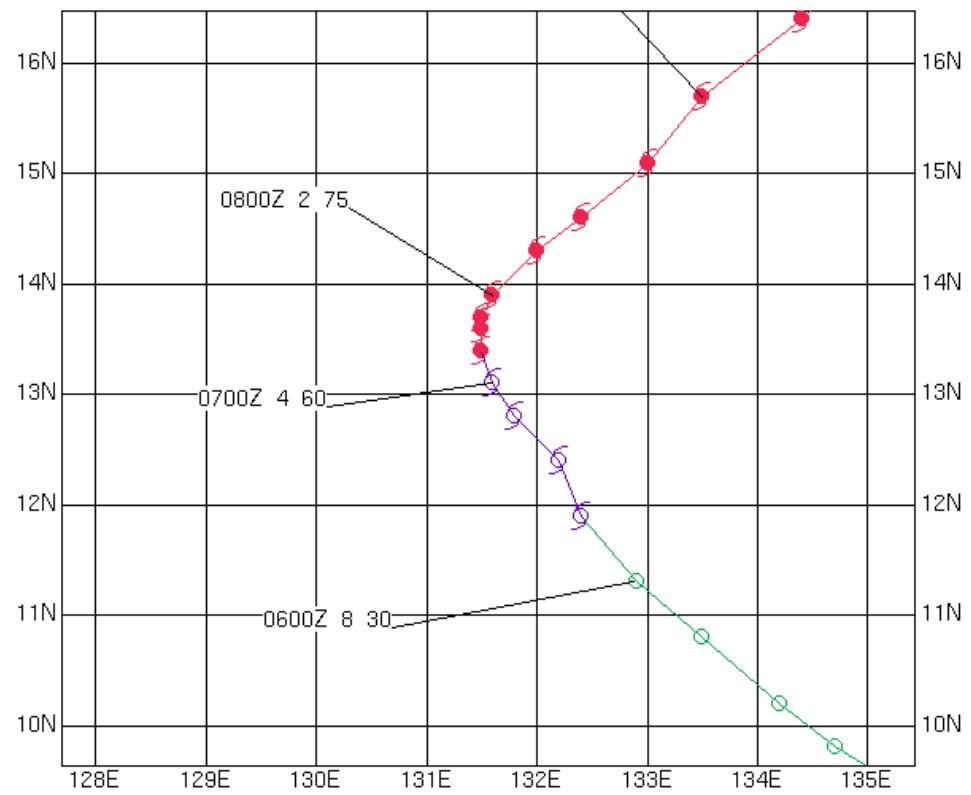


Figure 1-01W-5. 120716Z May 2000 GMS-5 visible image of the exposed low-level circulation. All the deep convection is located several degrees to the northeast. Synoptic data indicate the cyclone weakened as an upper-level trough approached from the northwest, increased the vertical shear, and displaced the upper-level circulation to the northeast.

**SUPER TYPHOON 01W (DAMREY)**  
**05 - 12 MAY 2000**





# **Tropical Storm (TS) 02W (Longwang\*)**

First Poor : 0600Z 15 May 00

First Fair : 2030Z 17 May 00

First TCFA : 0730Z 18 May 00

First Warning : 1800Z 19 May 00

Last Warning : 0600Z 20 May 00

Max Intensity : 45 kts, Gusts to 55 kts

Landfall : None

Total Warnings : 7

Remarks:

- (1) No noted impacts
- (2) Dissipated in the area between the Ryukyu and Bonin Islands

\* Name assigned by RSMC Tokyo

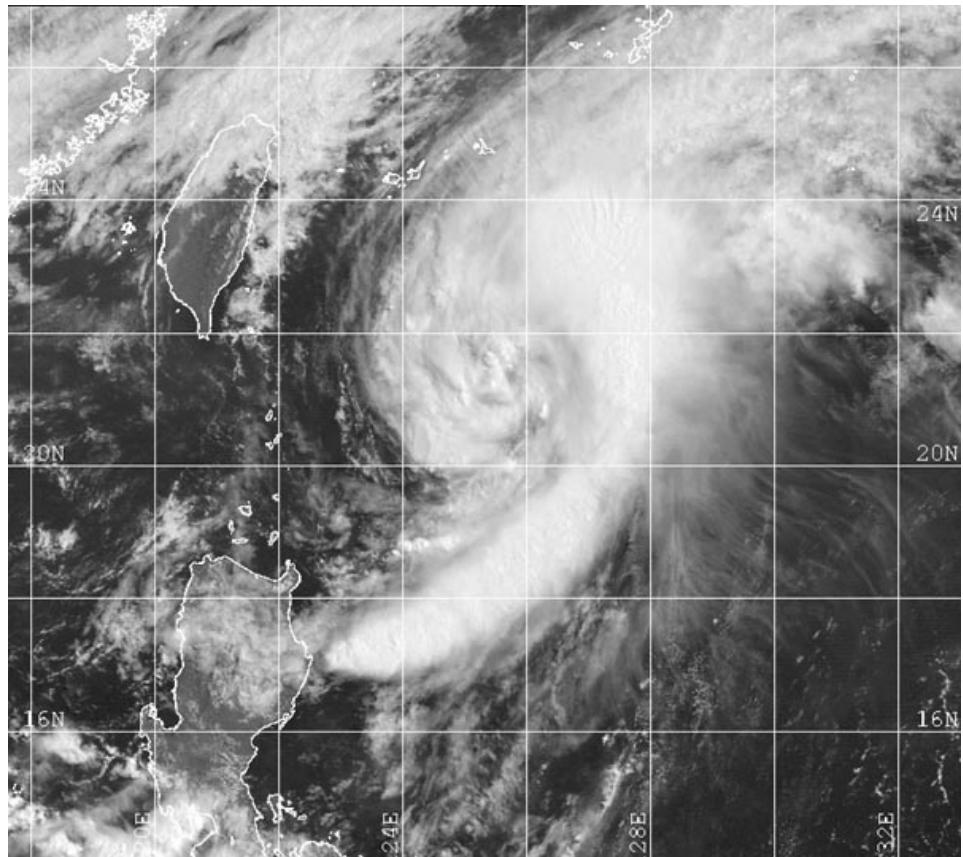
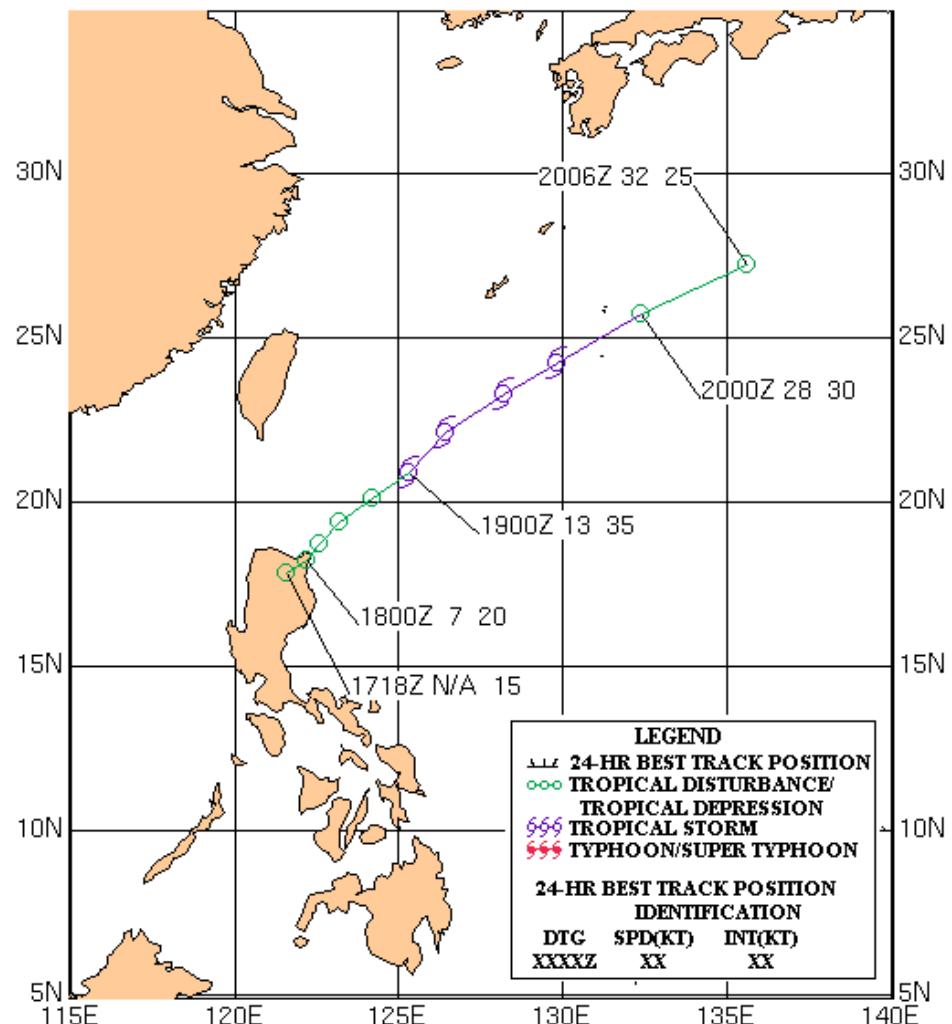


Figure 1-02W-1. 190031Z May 2000 GMS-5 visible image of TS 02W while located about 240 nm east-southeast of Taiwan. The first warning was issued as 02W moved northeast out of Luzon, Philippines on May 17th.

TROPICAL STORM 02W (LONGWANG)  
19 - 20 MAY 2000



## **Tropical Depression (TD) 03W**

First Poor : 0600Z 20 May 00

First Fair : None

First TCFA : None

First Warning : 0000Z 21 May 00

Last Warning : 0000Z 22 May 00

Max Intensity : 30 kts, Gusts to 40 kts

Landfall : None

Total Warnings : 5

Remarks : None

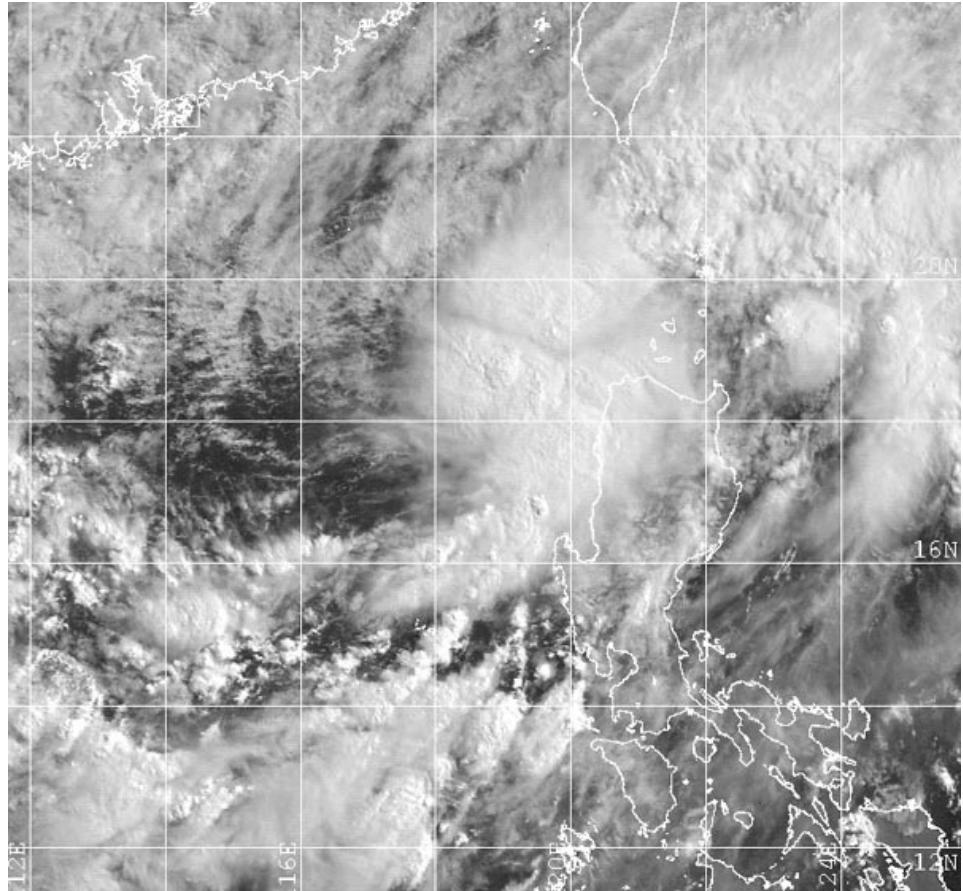


Figure 1-03W-1. 202331Z May 2000 GMS-5 visible image of the area of convection that became TD 03W. This cyclone developed northwest of Luzon, Philippines and tracked west through the Luzon Strait.

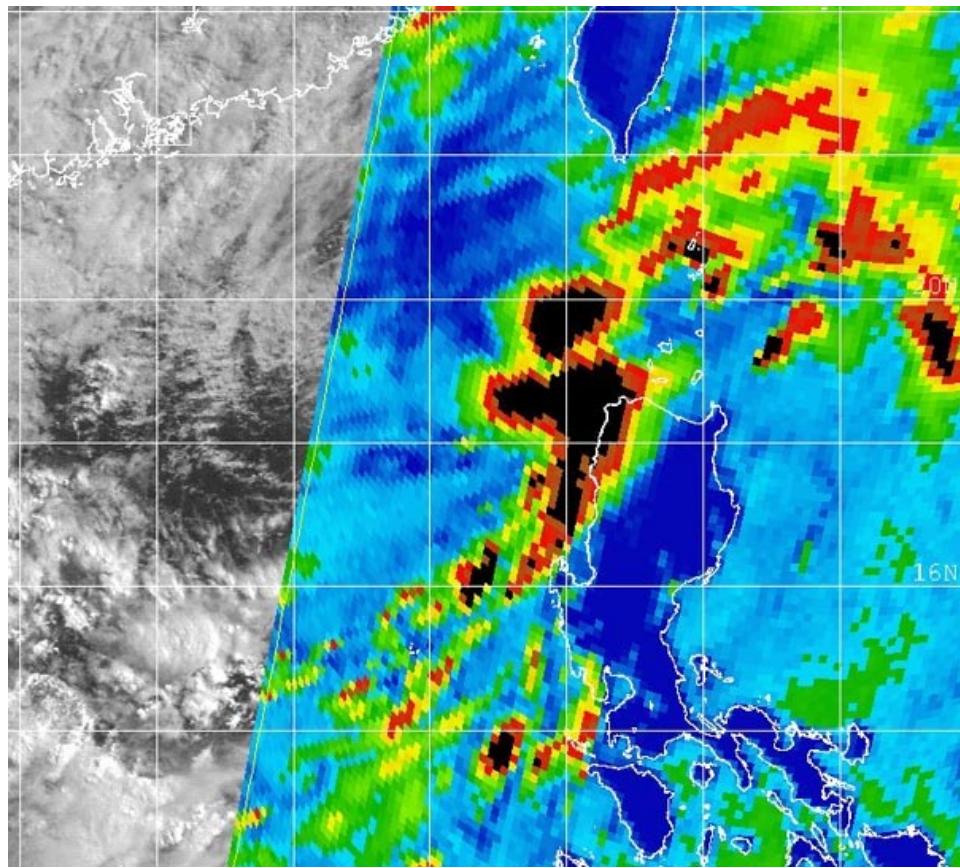
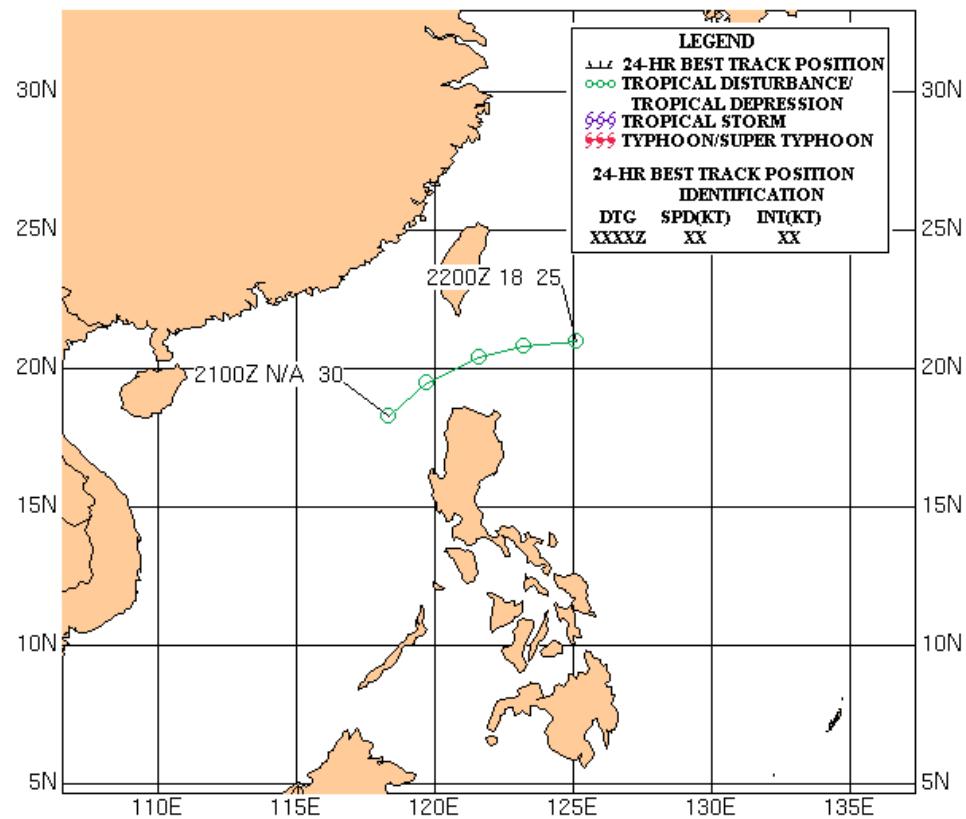


Figure 1-03W-2. 210042Z May 2000 SSMI 85 GHz image of TD 03W. All of the deep convection is located to the east and southeast side of the circulation center.

TROPICAL DEPRESSION 03W  
21 - 22 MAY 2000



# **Tropical Depression (TD) 04W**

First Poor : 0600Z 26 May 00

First Fair : 0200Z 29 May 00

First TCFA : 0530Z 30 May 00

First Warning : 1800Z 30 May 00

Last Warning : 0000Z 01 Jun 00

Max Intensity : 30 kts, Gusts to 40

Landfall : None

Total Warnings : 9\*

Remarks:

- (1) Post analysis could not verify or substantiate the 9th (final) JTWC warning position for this cyclone.  
Thus the final warning position was not used in error computation and that position was removed from the best track.

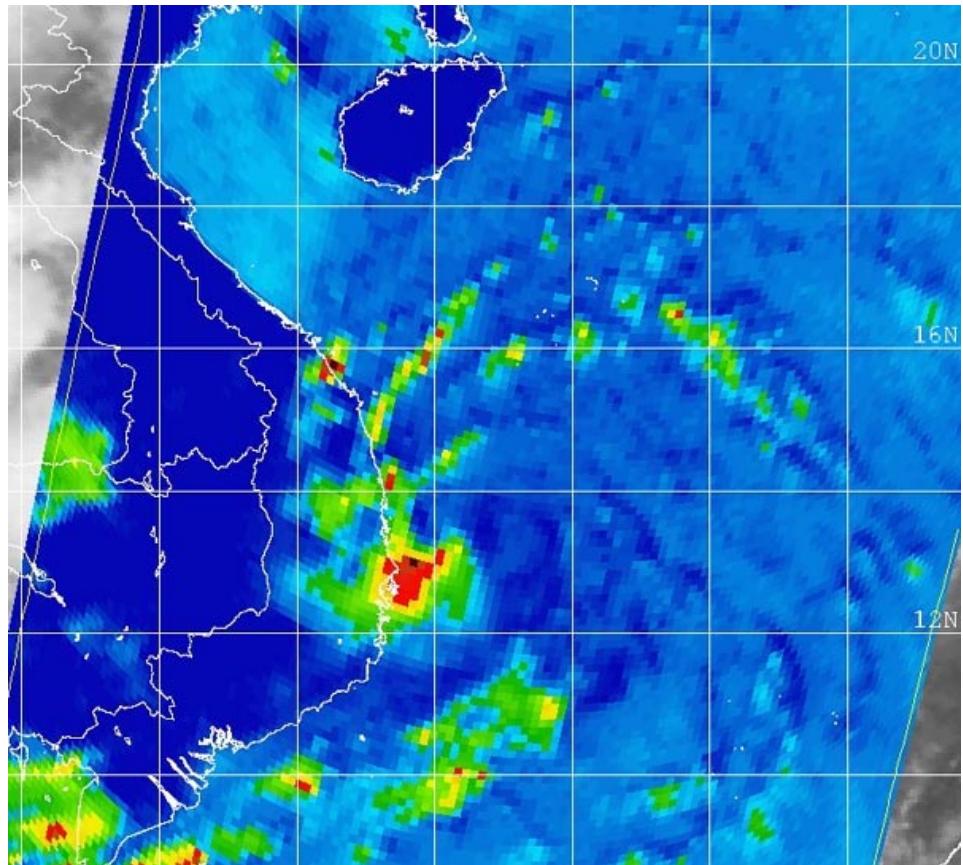


Figure 1-04W-1. 302245Z May 2000 SSMI 85 GHz image of TD 04W just off the coast of Vietnam. In this image, an area of convection can be seen to the west of the circulation, with narrow bands extending from this region towards the north.

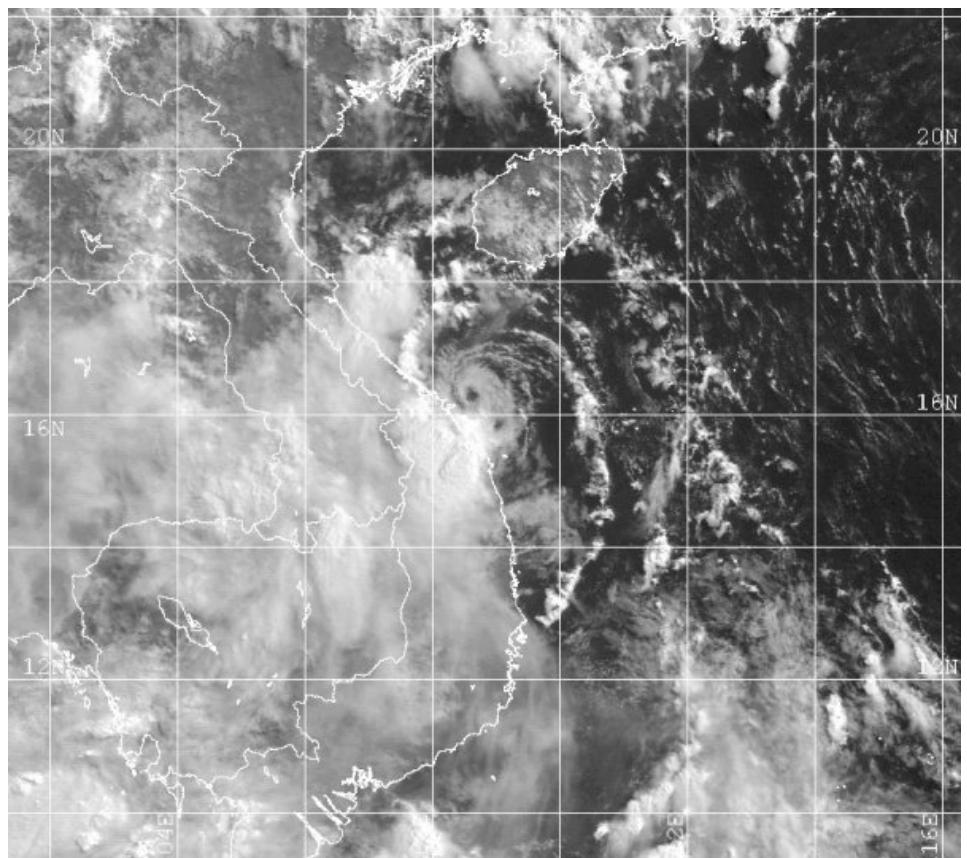
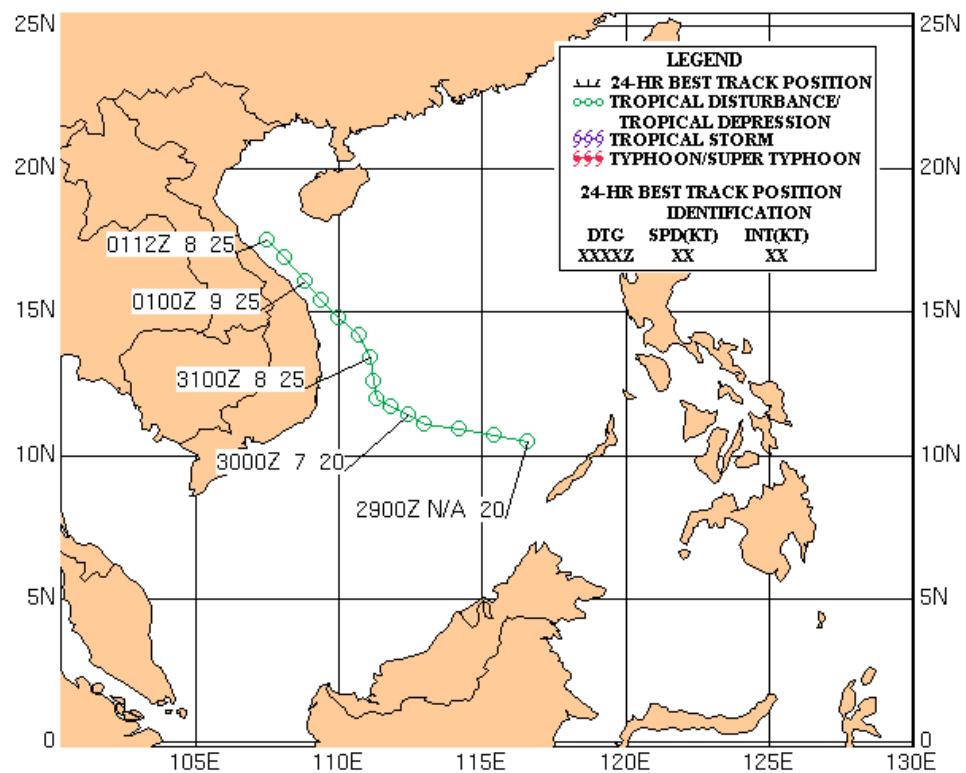


Figure 1-04W-2. 010144Z June 2000 GMS-5 visible image of TD 04W's exposed low-level circulation center.

TROPICAL DEPRESSION 04W  
30 MAY - 01 JUNE 2000



# Typhoon (TY) 05W (Kirogi\*)

First Poor : 1500Z 30 Jun 00

First Fair : 2000Z 01 Jul 00

First TCFA : 2300Z 01 Jul 00

First Warning : 0600Z 02 Jul 00

Last Warning : 1800Z 08 Jul 00

Max Intensity : 115 kts, Gusts to 140 kts

Landfall : None

Total Warnings : 27

Remarks:

- (1) One of two cyclones to simultaneously develop on either side of the Philippines. TY 05W developed in the Philippine Sea while TY 06W (Kai-Tak) formed in the South China Sea.
- (2) After initial development in the Philippine Sea, the cyclone moved north then northeast, brushing the Boso Peninsula, Honshu, Japan, causing three deaths and flooding in the region.
- (3) At 1800Z on 3 July, TY 05W attained typhoon intensity and then reached peak intensity of 115 knots 12 hours later.
- (4) By 2100Z on 7 July, TY 05W was located about 94 NM south of Tokyo, Japan and had weakened to minimum typhoon intensity (65 kts).
- (5) The passage of TY 05W disrupted power to about 20,000 people in several parts of central Japan and flooded 300 homes in the Kanto Plain.
- (6) The port of Mikayu, Japan recorded 312 mm of rain in 24 hours, more than double the July average of 127 mm for the station.

\* Name assigned by RSMC Tokyo

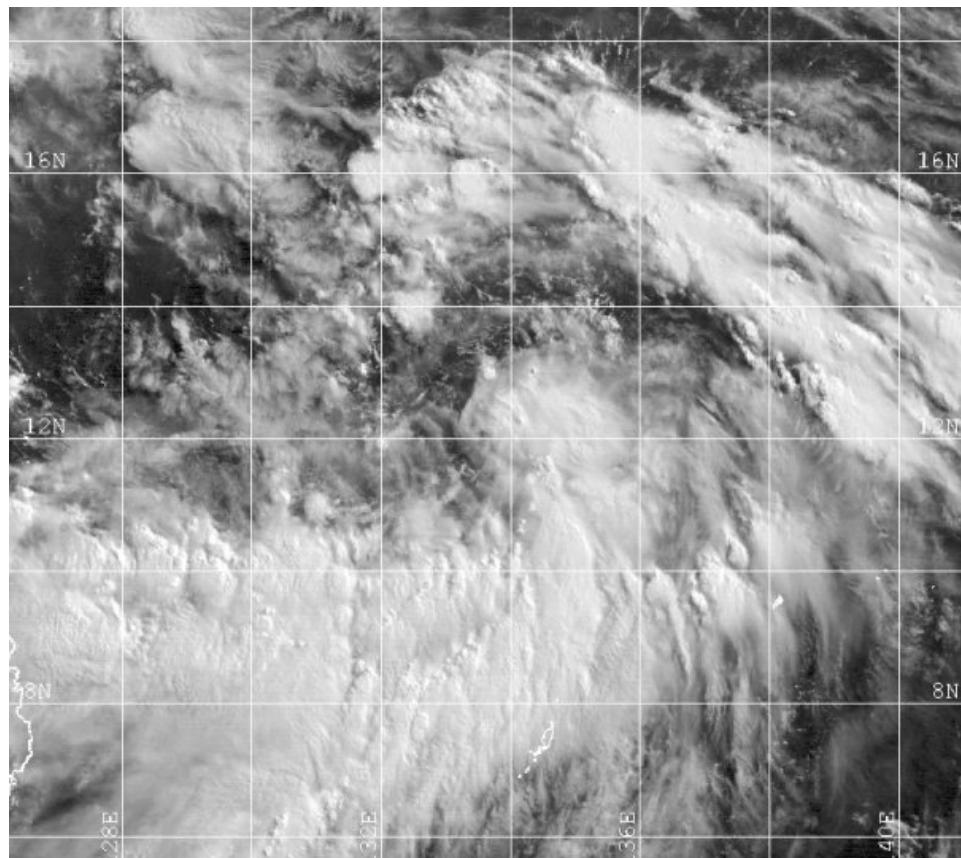


Figure 1-05W-1. 020005Z July 2000 GMS-5 visible image of TY 05W while at tropical depression intensity and located approximately 450 nm east of Mindanao Island.

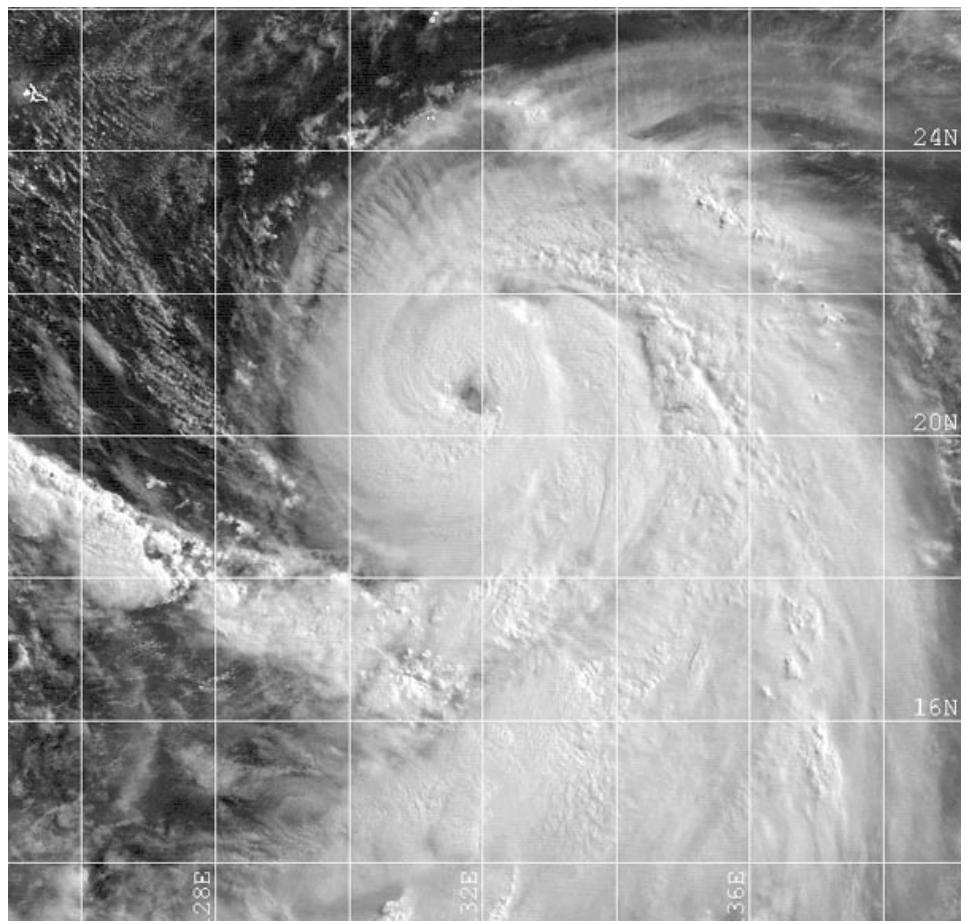


Figure 1-05W-2. 0422Z July 2000 GMS-5 visible image of TY 05W near peak intensity (115 knots). A well-defined eye and central dense overcast is easily seen with outflow extending in all directions.

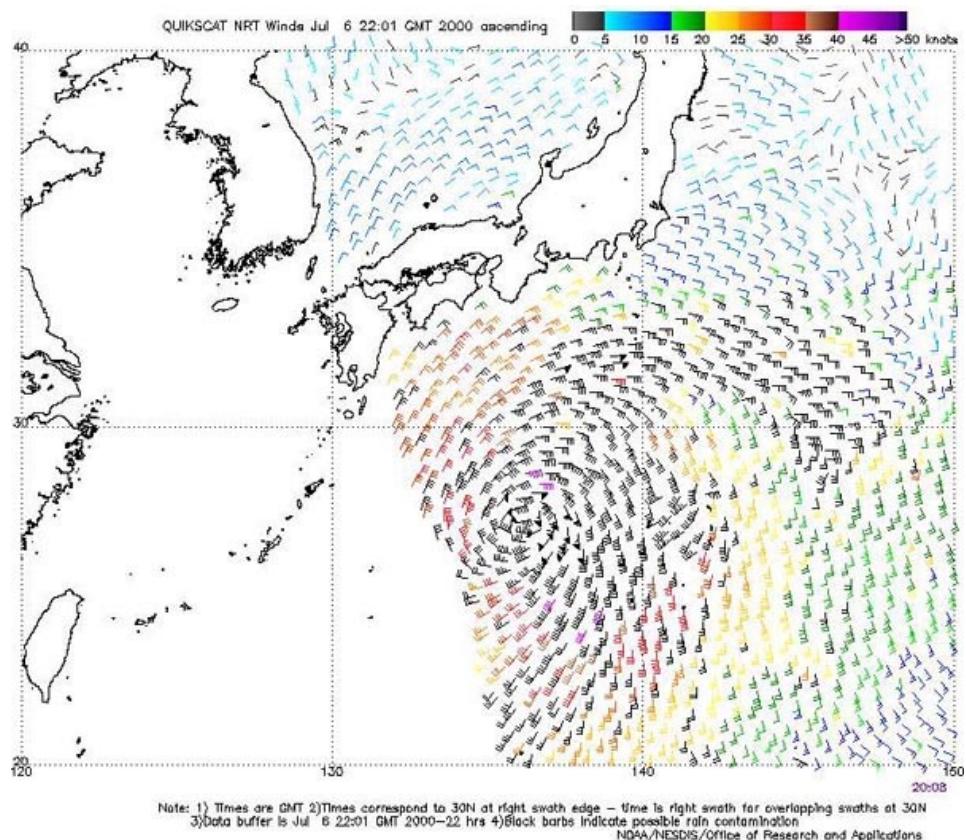


Figure 1-05W-3. 062201Z July 2000 QUIKSCAT pass over TY 05W. At this time, the storm has an estimated best track intensity of 75 knots and is moving northeast at 13 knots.

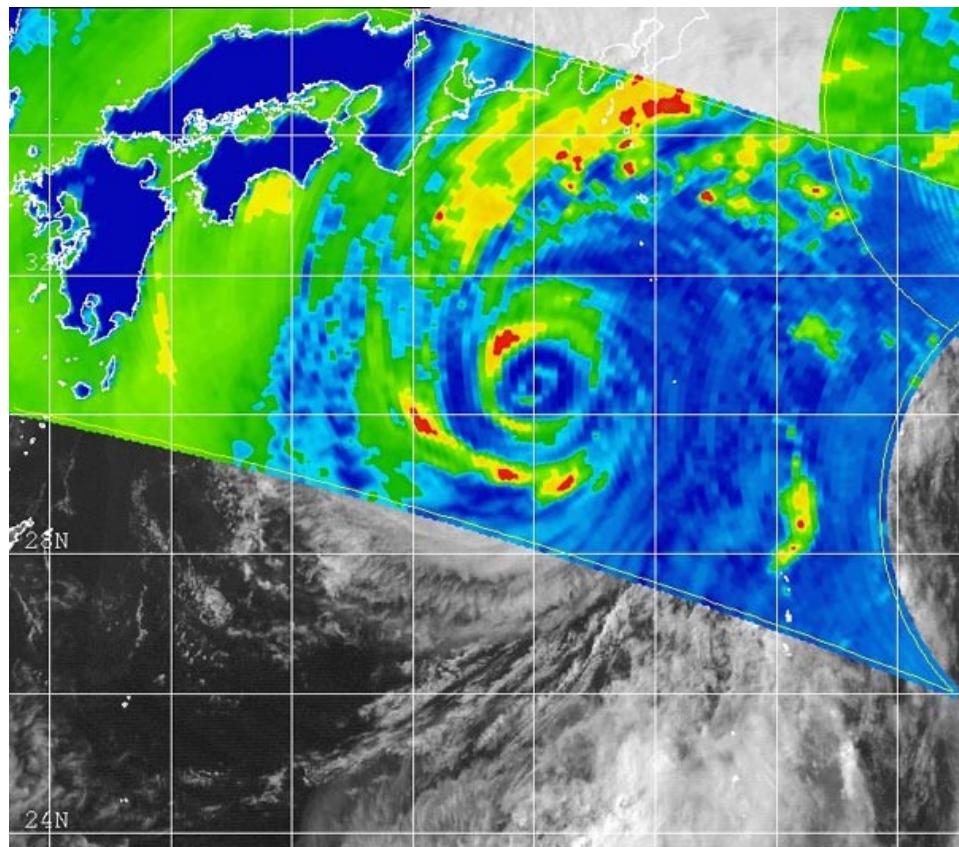


Figure 1-05W-4. 070736Z July 2000 TRMM 85 GHz image of TY 05W, located approximately 240 nm south of Nagoya, Japan. This data suggests the presence of concentric eyewalls and further indicates the impending passage over the Kanto Plain of a band of heavy convection associated with the cyclone.

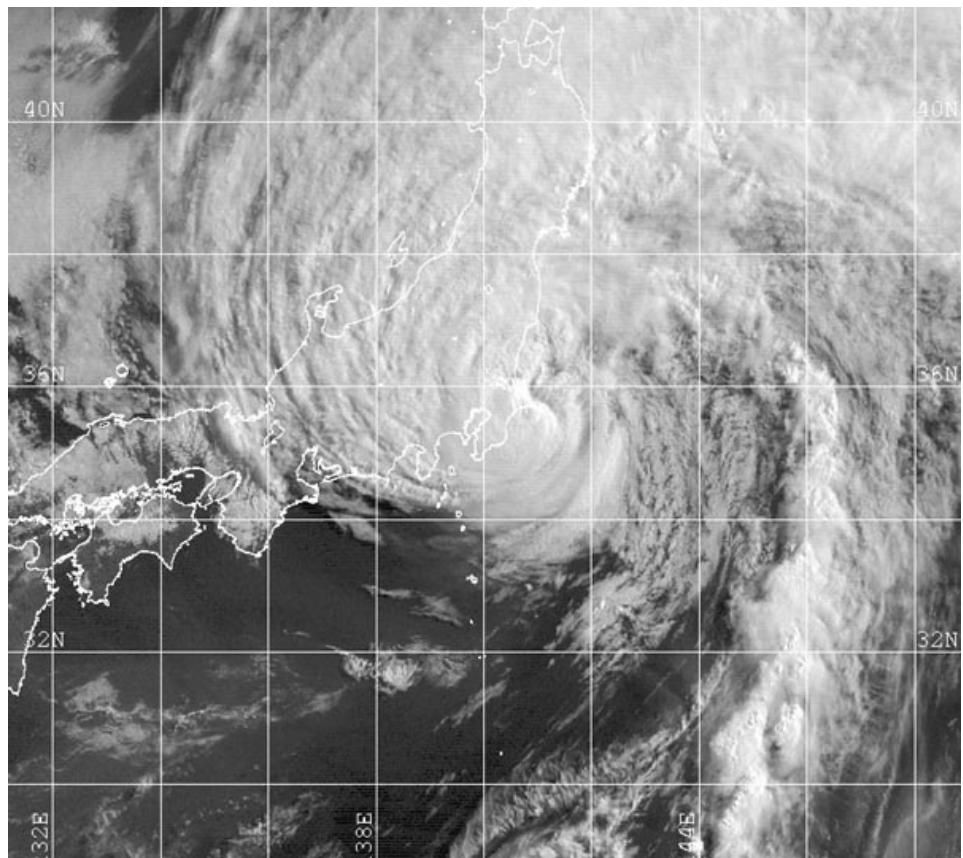
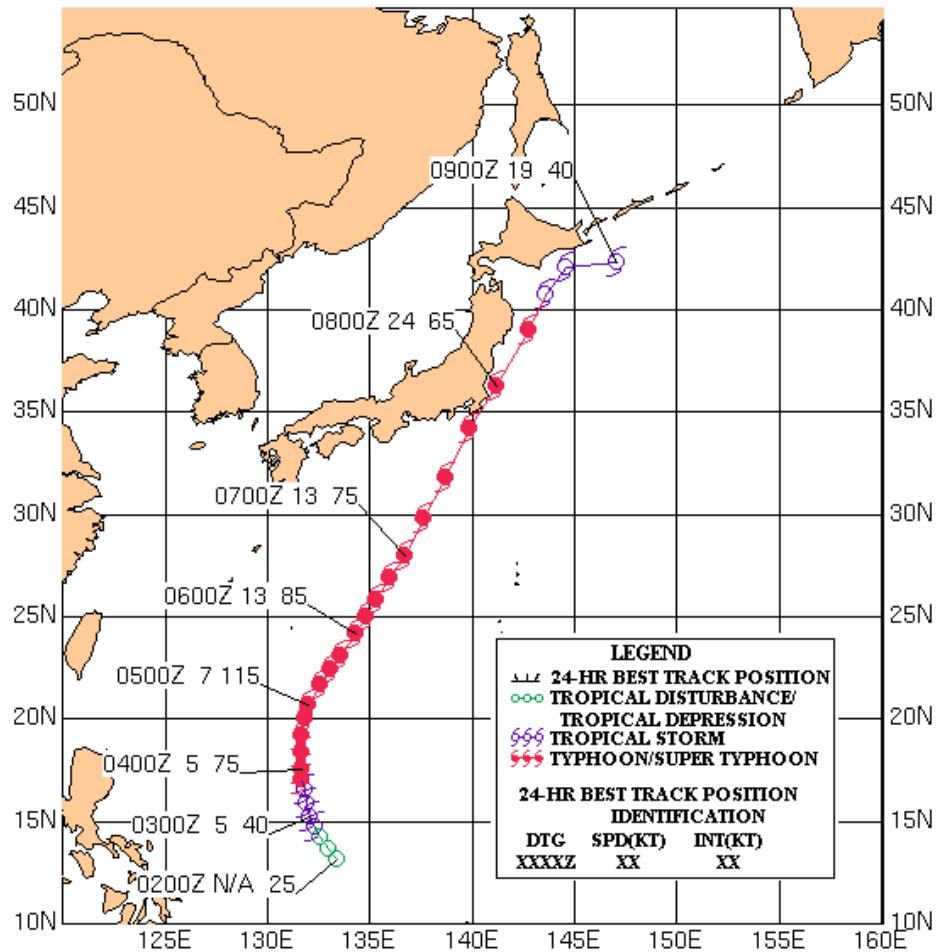


Figure 1-05W-5. 072131Z July 2000 GMS-5 visible image of TY 05W, with a partially exposed low-level circulation, after the cyclone had passed the Boso Peninsula.

**TYPHOON 05W (KIROGI)**  
**02 - 10 JULY 2000**



# Typhoon (TY) 06W (Kai-Tak\*)

First Poor : 0600Z 02 Jul 00

First Fair : 0000Z 03 Jul 00

First TCFA : 2200Z 03 Jul 00

First Warning : 0600Z 04 Jul 00

Last Warning : 0000Z 10 Jul 00

Max Intensity : 75 kts, Gusts to 90 kts

Landfall : 0700Z 09 Jul 00 over Taiwan; 2100Z 09 Jul 00 over China

Total Warnings : 28

Remarks:

- (1) Developed in the South China Sea as TY 05W (Kirogi) was developing in the Philippine Sea.
- (2) Precipitation associated with TY 06W and TY 05W caused numerous deaths and flooding in the Philippines. Laoag, Luzon recorded 444 mm of rain in 60 hours beginning on July 5, almost equaling the station's monthly average. The Philippine Defense Secretary reported that TY 06W destroyed more than 5000 homes and caused approximately 128 million Peso (\$2.9 million) in damages to crops and livestock. About 800,000 people were reported to have fled their homes because of flooding.
- (3) TY 06W was blamed for the deaths of 27 individuals due to flooding and landslides in the northern and central portions of Luzon. Near Manila, a 2.5-acre portion of a rain-soaked dumpsite collapsed and caught fire, killing 160 people with an additional 150 missing.
- (4) Between 5 and 8 July, while in the Luzon Strait, TY 06W made a slow and small cyclonic loop and intensified to typhoon strength.
- (5) TY 06W paralleled the southeast Taiwan coast before making landfall over northeast Taiwan around 0700Z on July 9th. The cyclone disrupted power to more than 3000 homes in Taiwan's Pingtung County and killed one person. The Taiwan Central Weather Bureau reported winds up to 80 kts during landfall.
- (6) After crossing the Taiwan Strait, TY 06W made landfall in mainland China around 2100Z on July 9, over Zhejiang province near Shanghai. The China Meteorological Administration reported direct economic losses estimated at \$82 million.

\* Name assigned by RSMC Tokyo

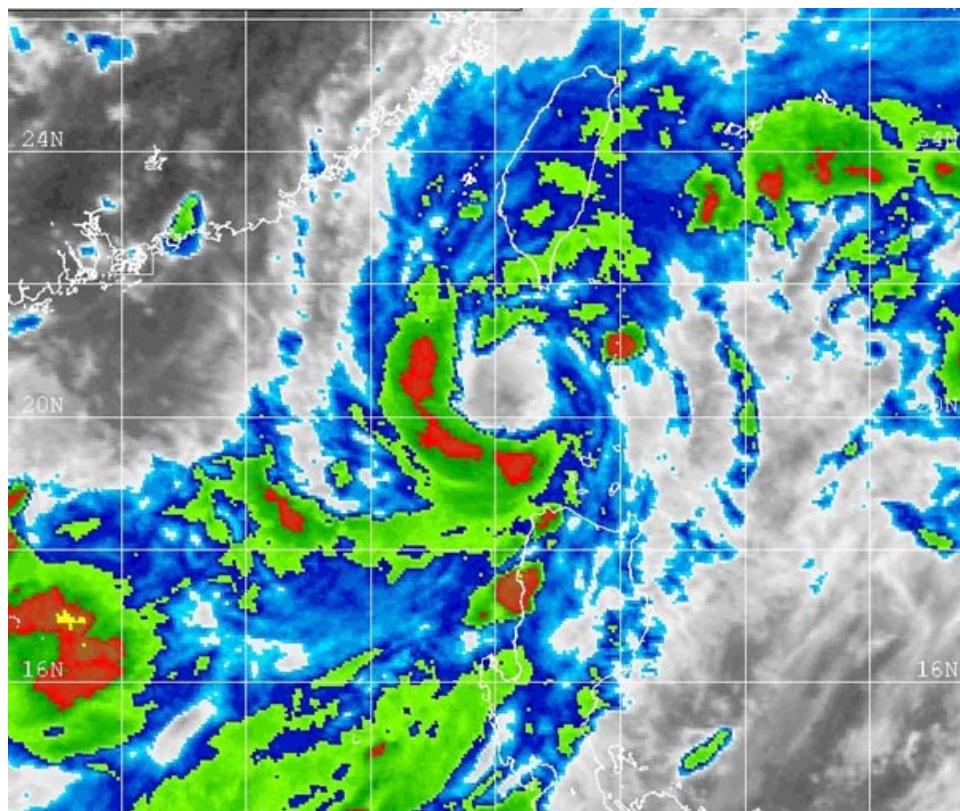


Figure 1-06W-1. 080931Z July 2000 GMS-5 enhanced infrared image of TY 06W approaching Taiwan from the southwest.

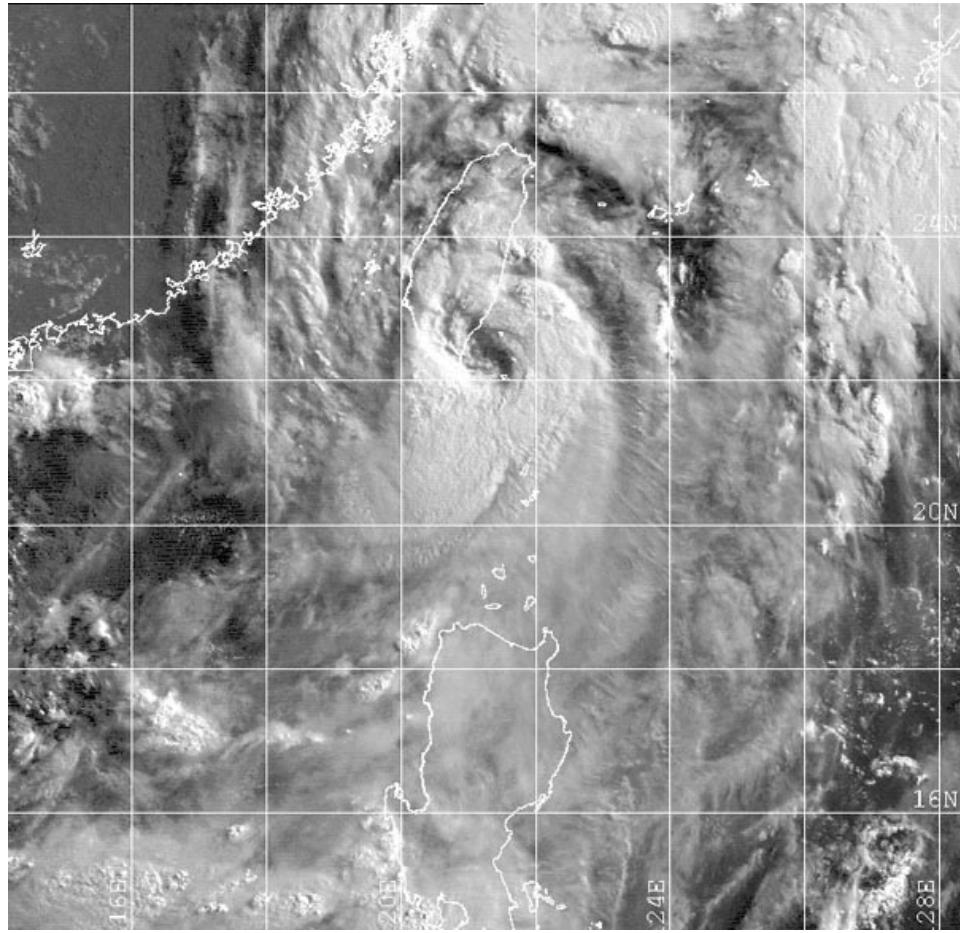


Figure 1-06W-2. 0822Z July 2000 GMS-5 visible image of TY 06W as the eyewall skirts the southern coast of Taiwan. Interaction with Taiwan's central mountain range is evident in the incomplete eyewall on the northwest side of the circulation center.

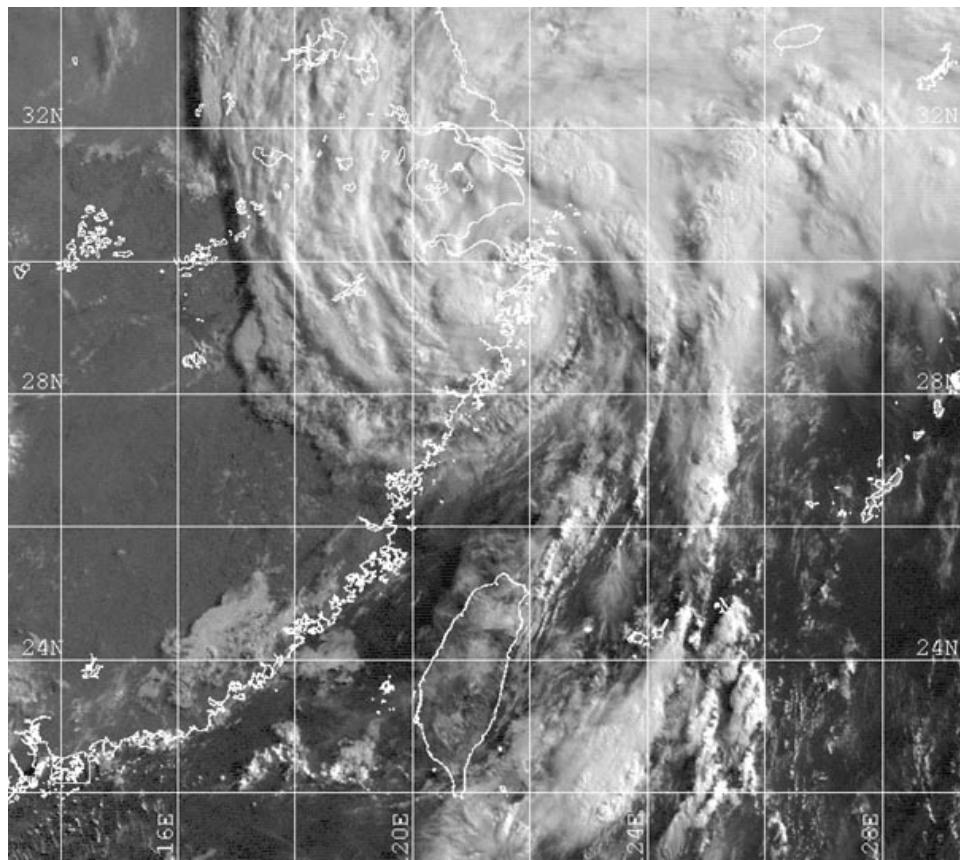
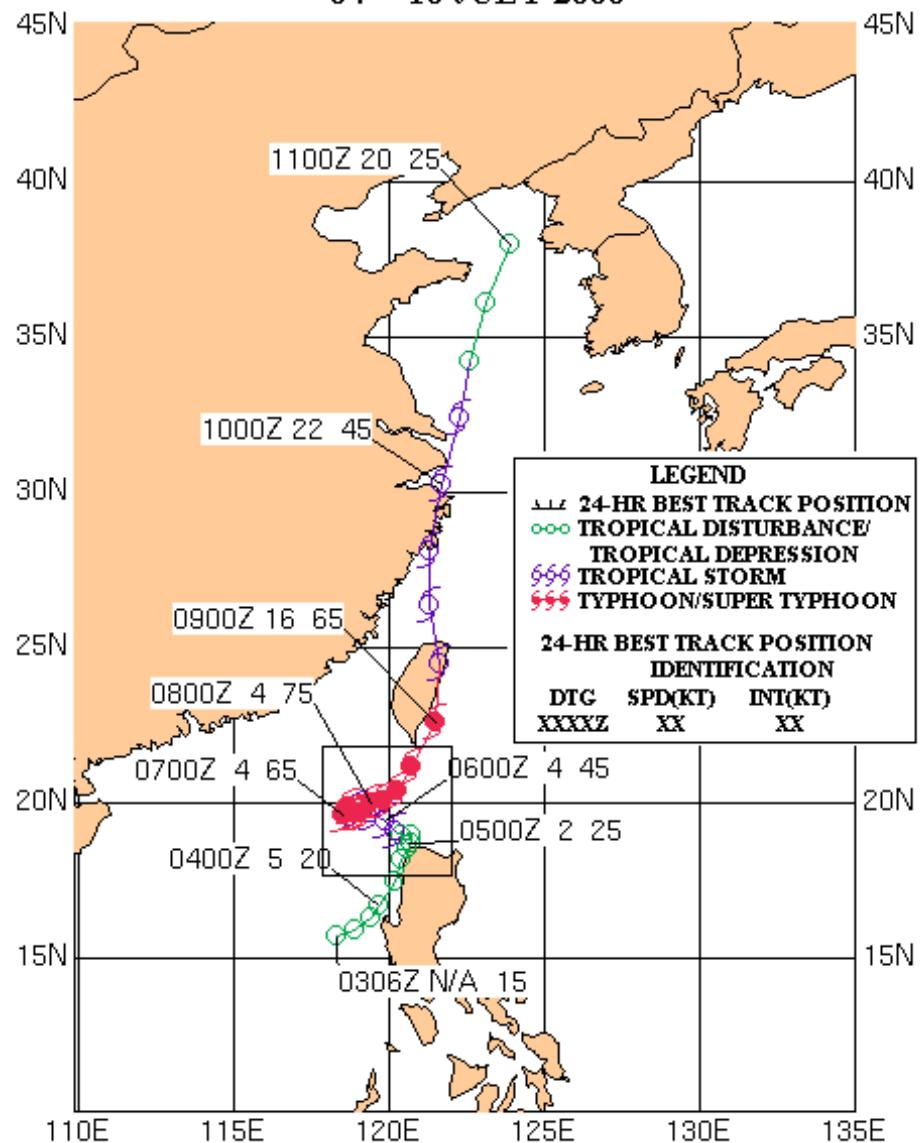
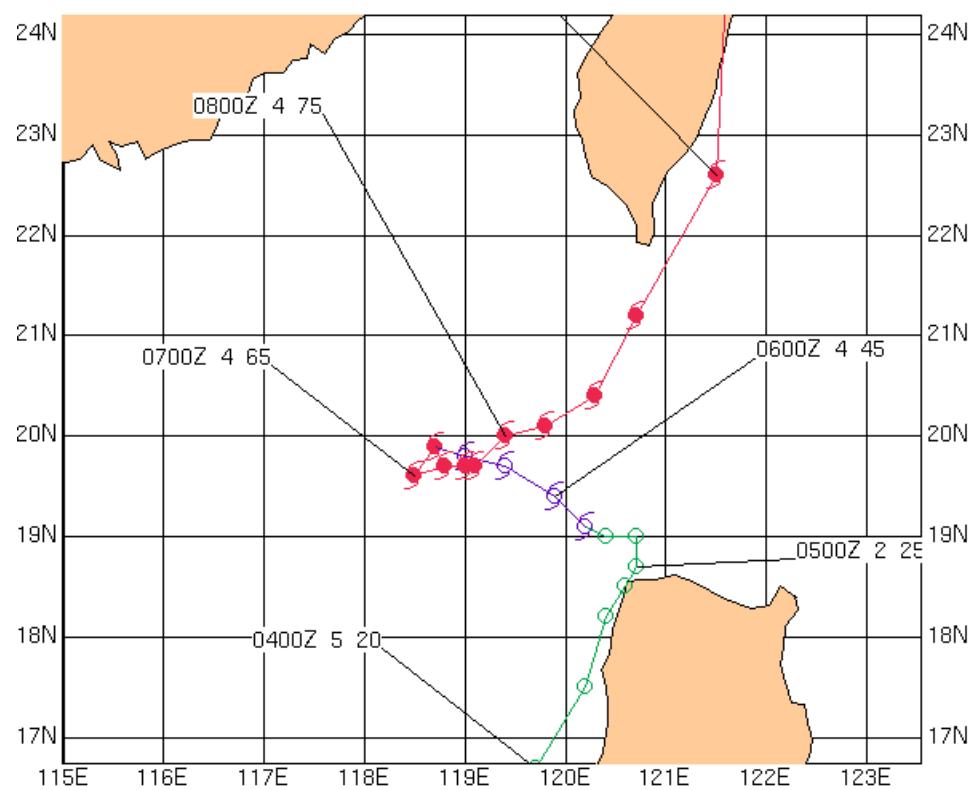


Figure 1-06W-3. 0922Z July 2000 GMS-5 visible image of TY 06W shortly after making landfall on mainland China south of Shanghai.

**TYPHOON 06W (KAI-TAK)**  
**04 - 10 JULY 2000**



See below to view inset detail



## **Tropical Depression (TD) 07W**

First Poor : 0130Z 09 Jul 00

First Fair : 2330Z 09 Jul 00

First TCFA : 0300Z 11 Jul 00

First Warning : 0000Z 13 Jul 00

Last Warning : 0000Z 15 Jul 00

Max Intensity : 25 kts, Gusts to

Landfall : 2300Z 13 Jul 00 over Luzon

Total Warnings : 9

Remarks : None

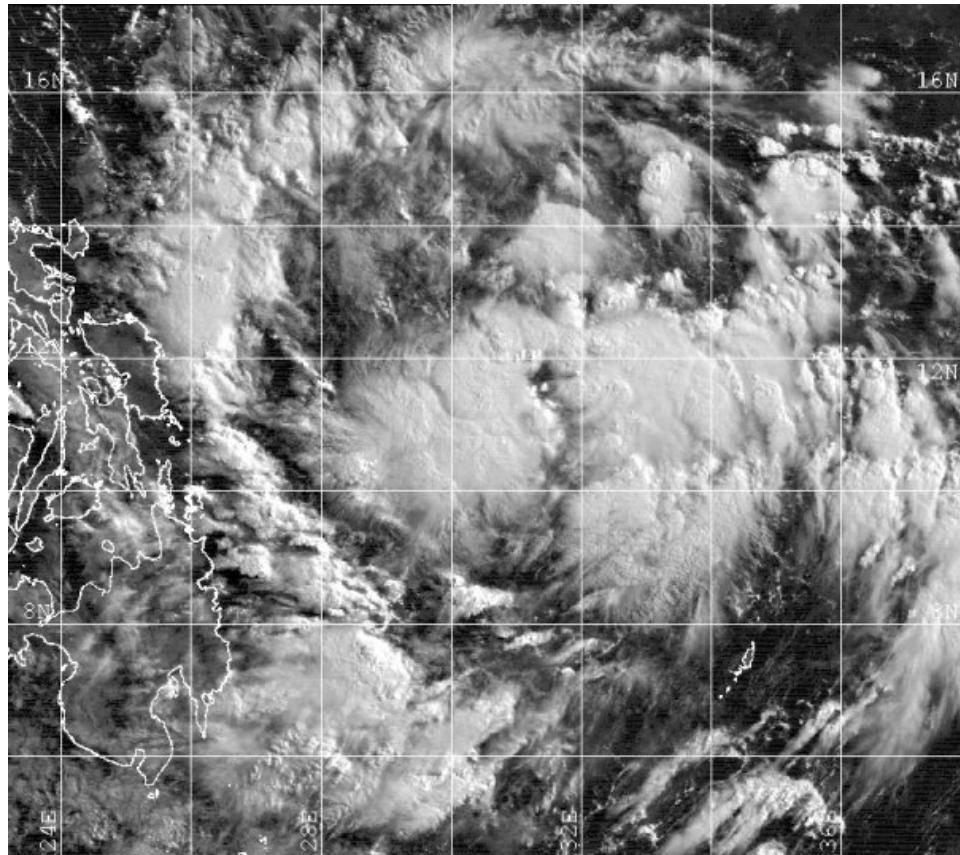


Figure 1-07W-1. 1022Z July 2000 GMS-5 visible image of the convection which developed into TD 07W. Extensive convection is noted over the central region of the disturbance, located about 400 nm east of Leyte Island.

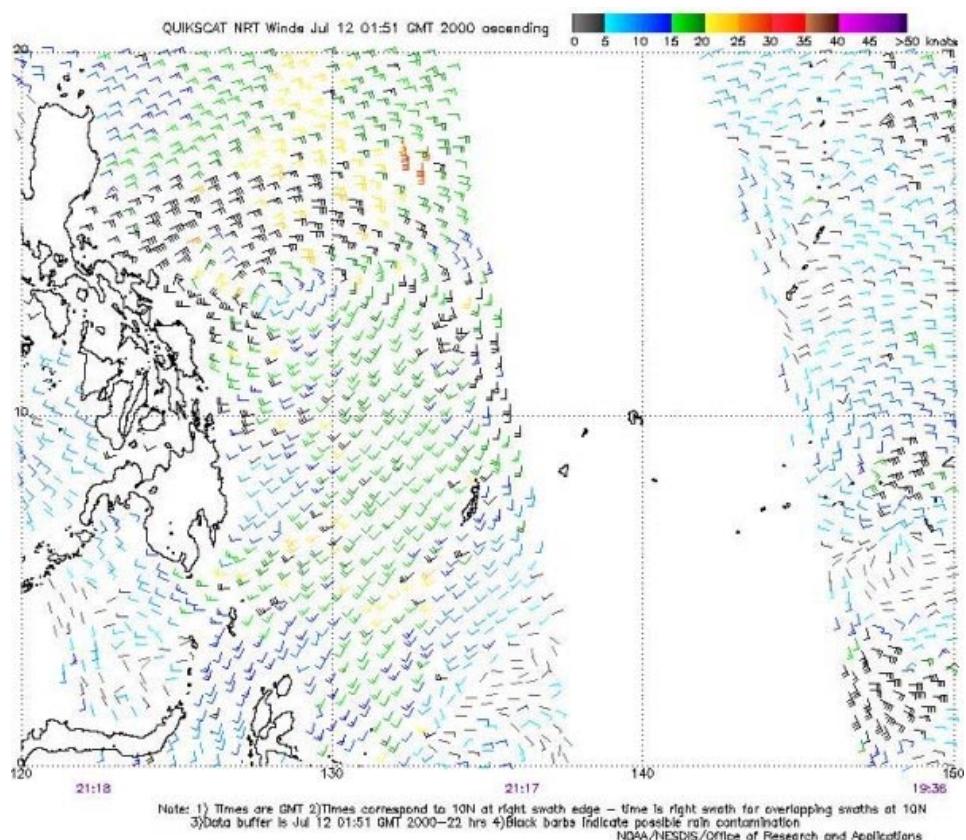
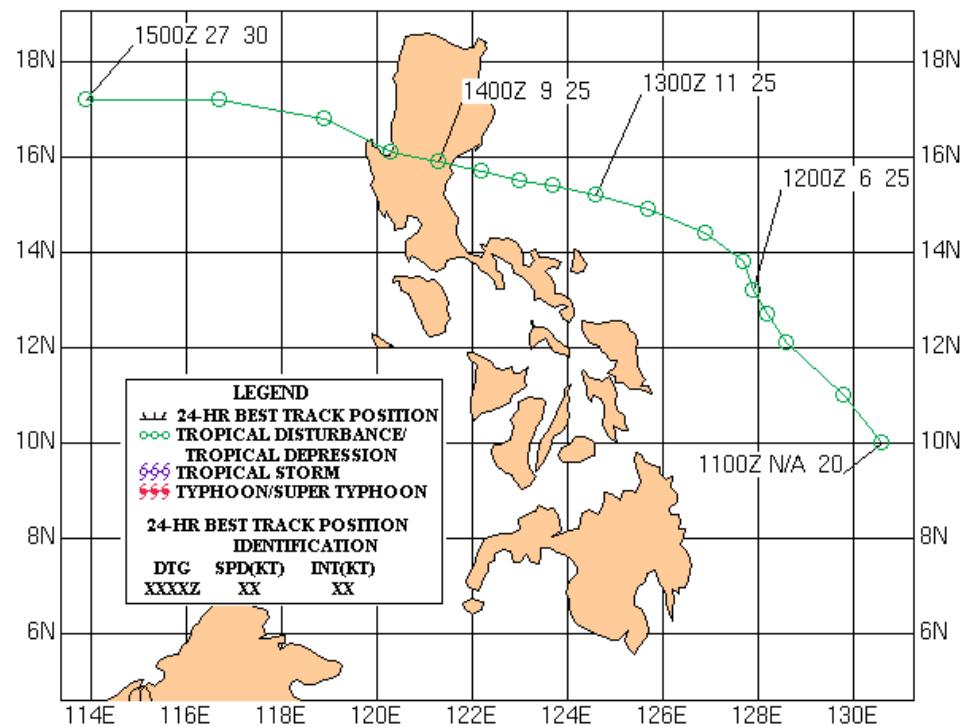


Figure 1-07W-2. 120151Z July 2000 QUIKSCAT pass over TD 07W with well-developed closed circulation.

**TROPICAL DEPRESSION 07W**  
**11-15 JULY 2000**



## **Tropical Depression (TD) 08W**

First Poor : 0600Z 14 Jul 00

First Fair : 1800Z 14 Jul 00

First TCFA : 0900Z 15 Jul 00

First Warning : 0000Z 16 Jul 00

Last Warning : 1200Z 17 Jul 00

Max Intensity : 25 kts, Gusts to 35 kts

Landfall : 0500Z 17 Jul 00 over China

Total Warnings : 7

Remarks : None

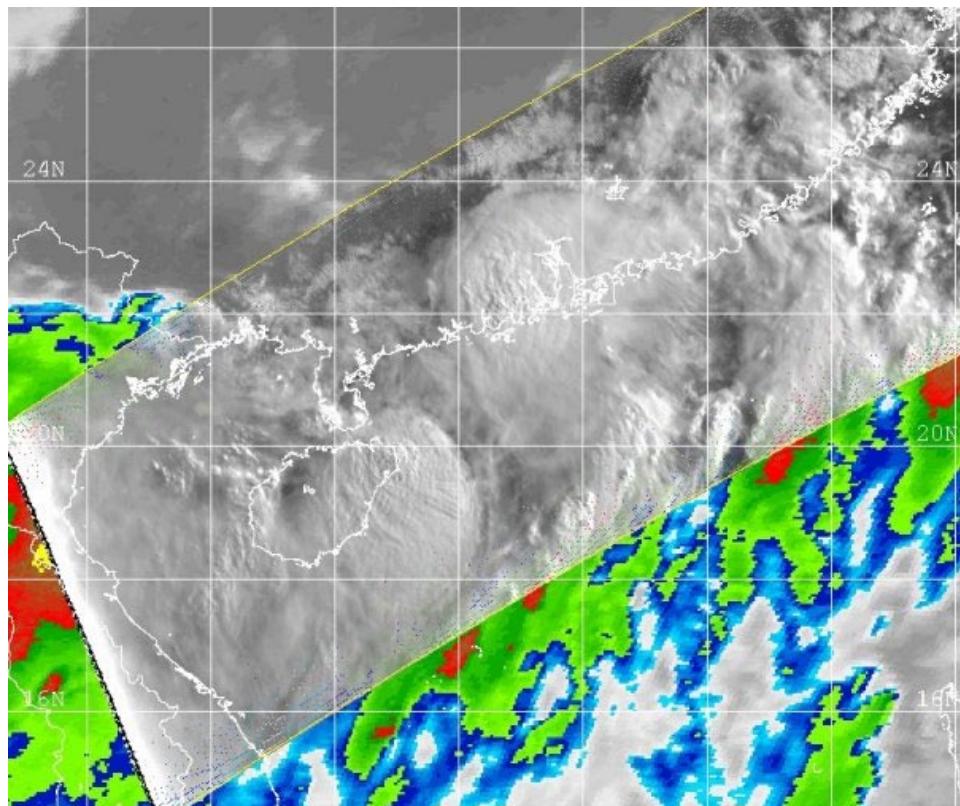


Figure 1-08W-1. 1622Z July 2000 TRMM visible image of TD 08W, a few hours before the cyclone made landfall west of Hong Kong.

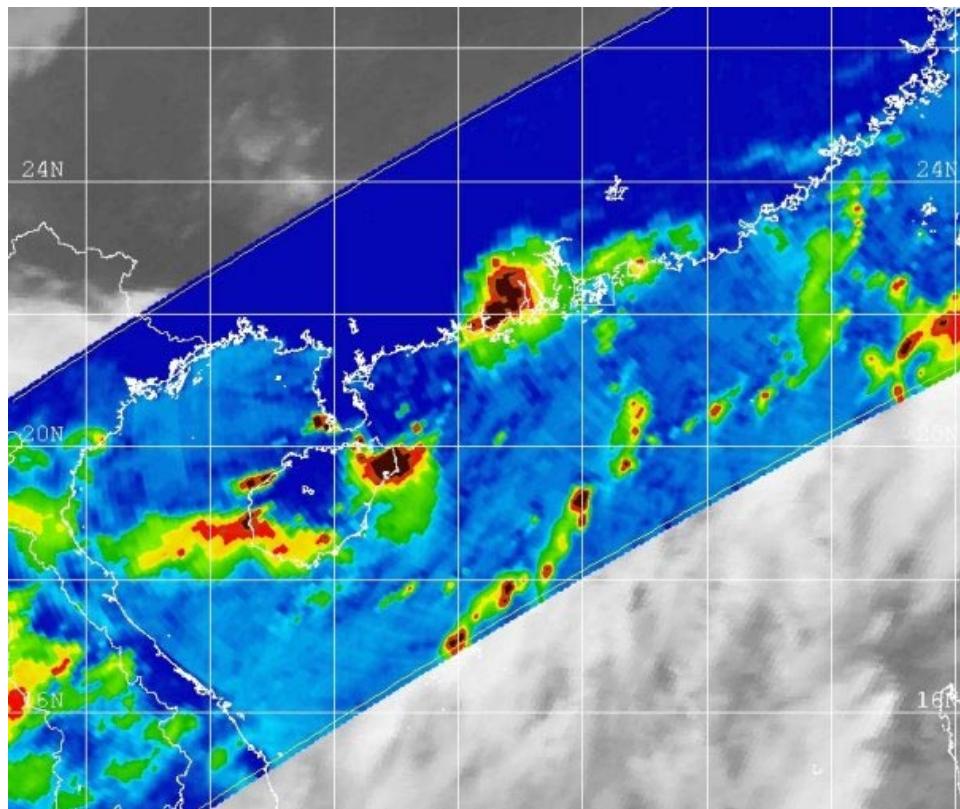
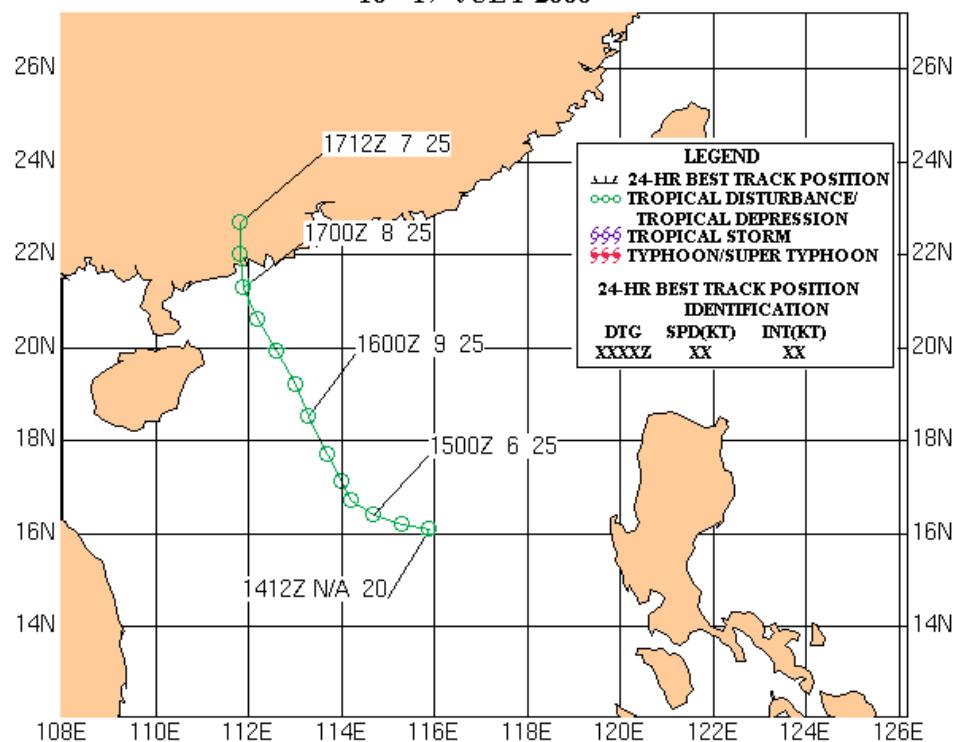


Figure 1-08W-2. 162238Z July 2000 TRMM 85 GHz image of TD 08W, with areas of deep convection mostly over Hainan Island and mainland China.

### TROPICAL DEPRESSION 08W

16 - 17 JULY 2000



## **Tropical Storm (TS) 09W (Tembin\*)**

First Poor : 1900Z 16 Jul 00

First Fair : 2300Z 16 Jul 00

First TCFA : 0130Z 17 Jul 00

First Warning : 1800Z 17 Jul 00

Last Warning : 0000Z 23 Jul 00

Max Intensity : 45 kts, Gusts to 55 kts

Landfall : None

Total Warnings : 22

Remarks : None

\* Name assigned by RSMC Tokyo

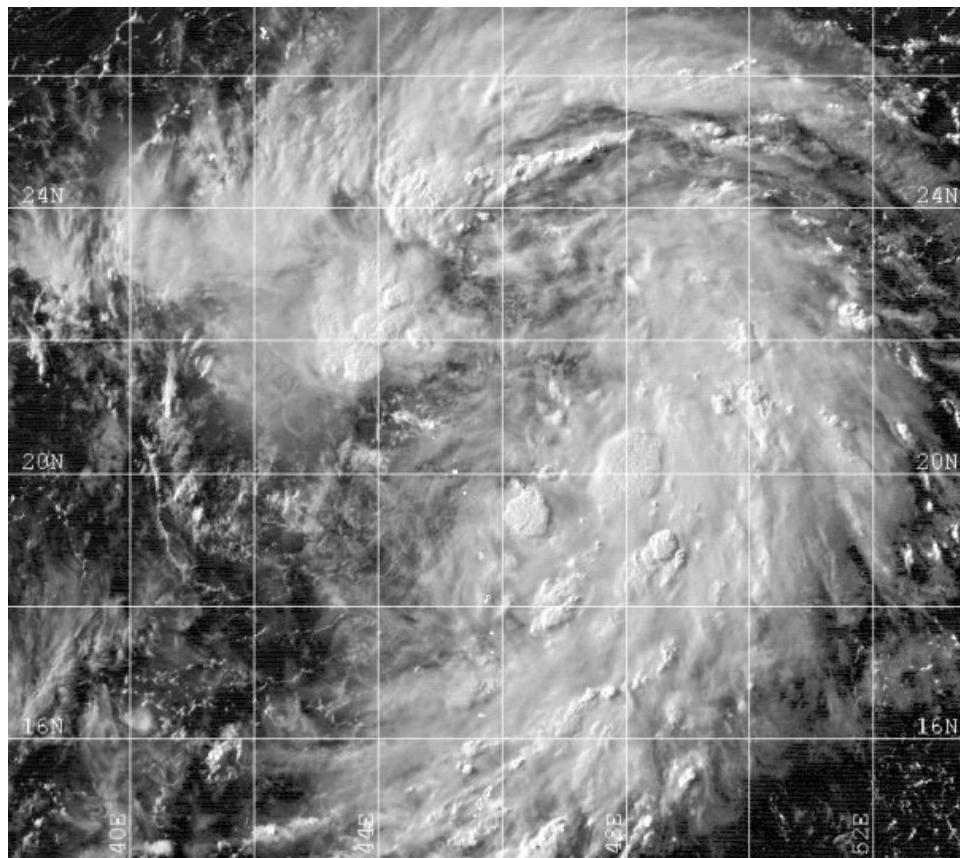


Figure 1-09W-1. 170731Z July 2000 GMS-5 visible image of the initial disturbance which became TS 09W. A broad area of deep convection can be seen around the center of this disturbance.

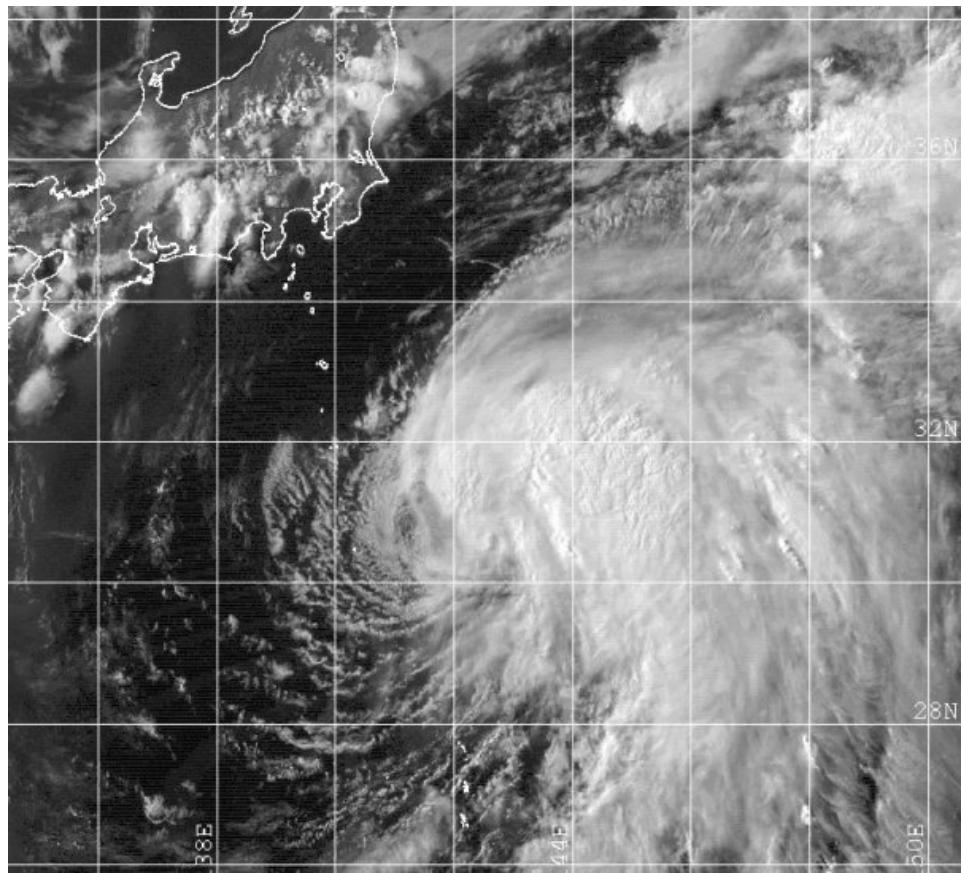


Figure 1-09W-2. 200731Z July 2000 GMS-5 visible image of TS 09W shortly after the cyclone reached maximum intensity. The effect of vertical shear is evident, with the deep convection displaced northeast of the low-level circulation center.

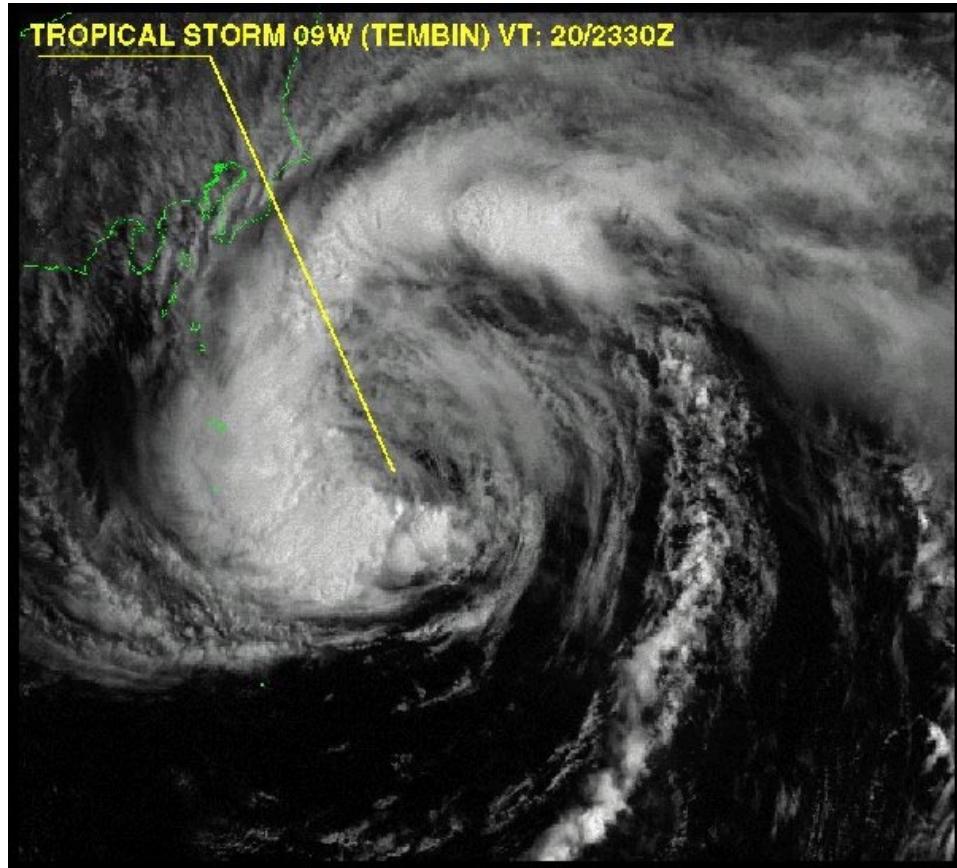
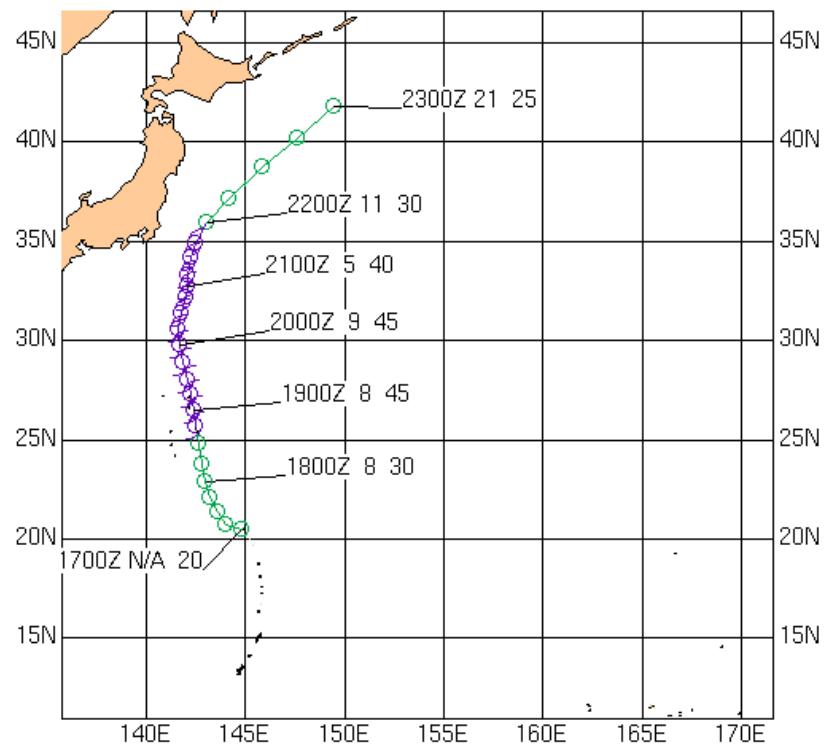


Figure 1-09W-3. 202330Z July 2000 GMS-5 visible image of TS 09W, with the deep convection west of the low-level circulation center.

TROPICAL STORM 09W (TEMBIN)  
17 - 23 JULY 2000



# **Tropical Depression (TD) 10W**

First Poor : 0600Z 18 Jul 00

First Fair : None

First TCFA : 0030Z 20 Jul 00

First Warning : 0000Z 20 Jul 00

Last Warning : 0000Z 23 Jul 00

Max Intensity : 25 kts, Gusts to 35 kts

Landfall : 0000Z 23 Jul 00 over Northern Luzon as it dissipated

Total Warnings : 13

Remarks : None

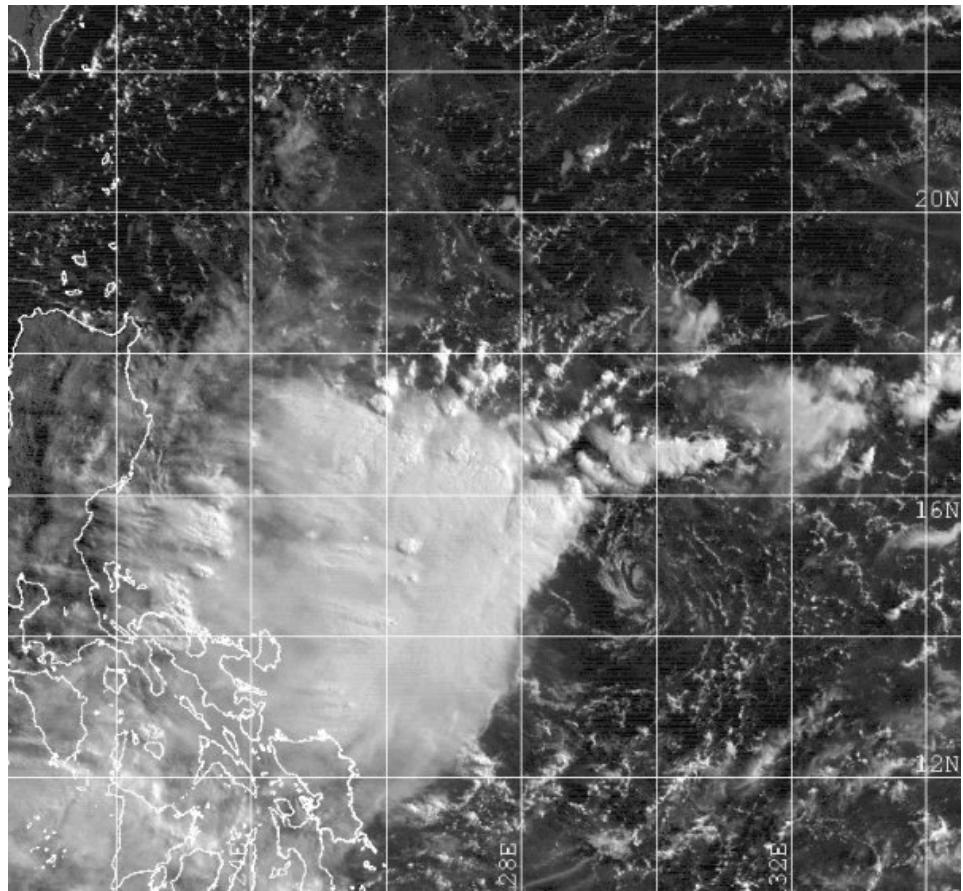


Figure 1-10W-1. 2022Z July 2000 GMS-5 visible image of TD 10W when the cyclone was about 400 nm east of Luzon, with the low-level circulation center well separated from any deep convection.

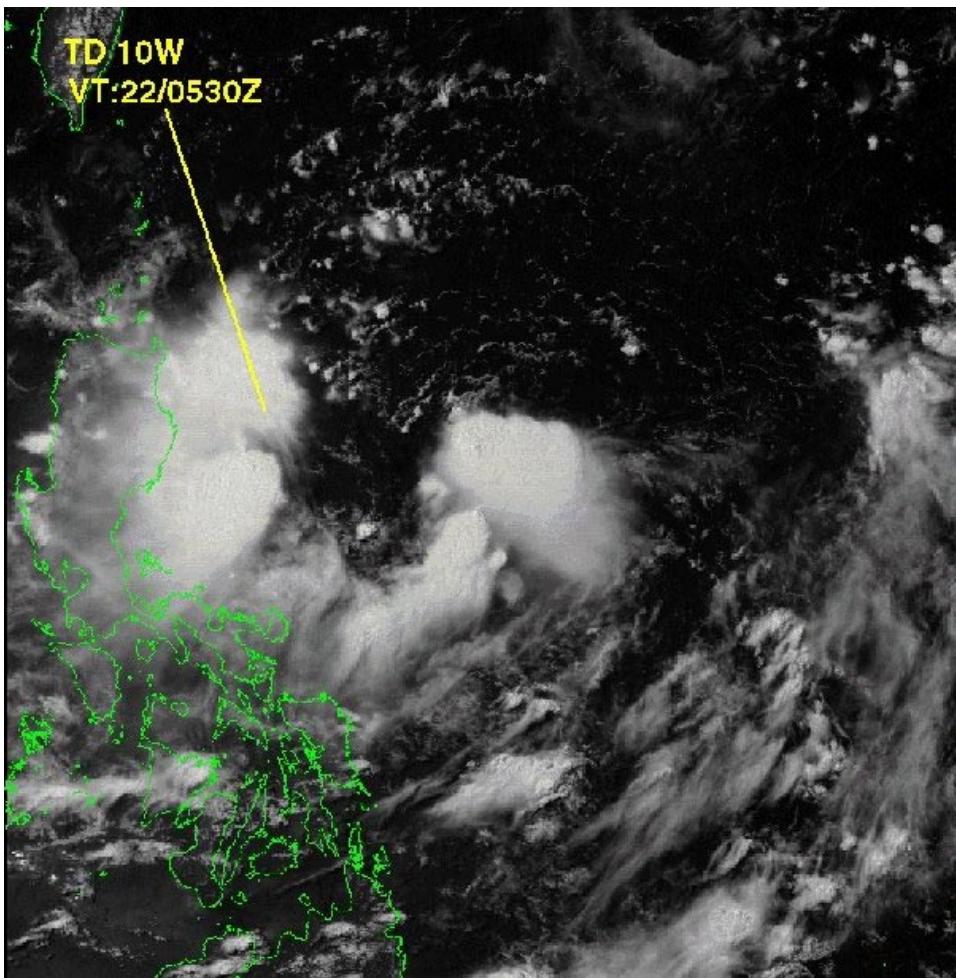
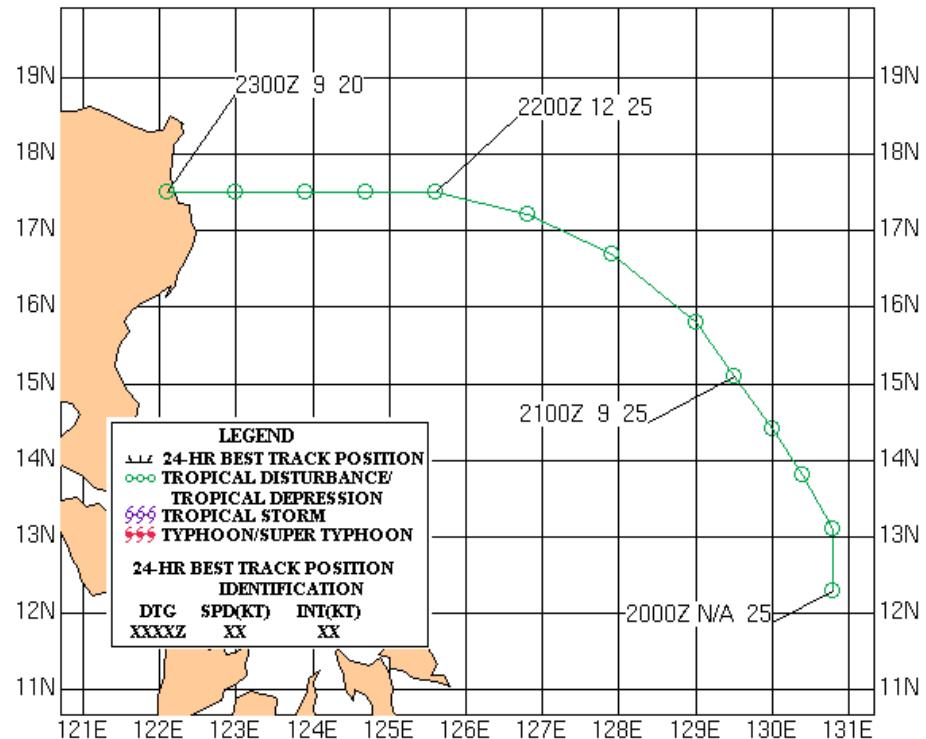


Figure 1-10W-2. 220530Z July 2000 GMS-5 visible image of TD 10W, located about 180 nm east of Luzon.

**TROPICAL DEPRESSSION 10W**  
**20 - 23 JULY 2000**



## **Tropical Storm (TS) 11W (Bolaven\*)**

First Poor : 0600Z 23 Jul 00

First Fair : 2130Z 23 Jul 00

First TCFA : 0030Z 24 Jul 00

First Warning : 1800Z 24 Jul 00

Last Warning : 0600Z 31 Jul 00

Max Intensity : 50 kts, Gusts to 65 kts

Landfall : None

Total Warnings : 27

Remarks:

- (1) According to Japanese Meteorological Agency reports, Okinawa and southern Kyushu experienced damage due to heavy rainfall.

\* Name assigned by RSMC Tokyo

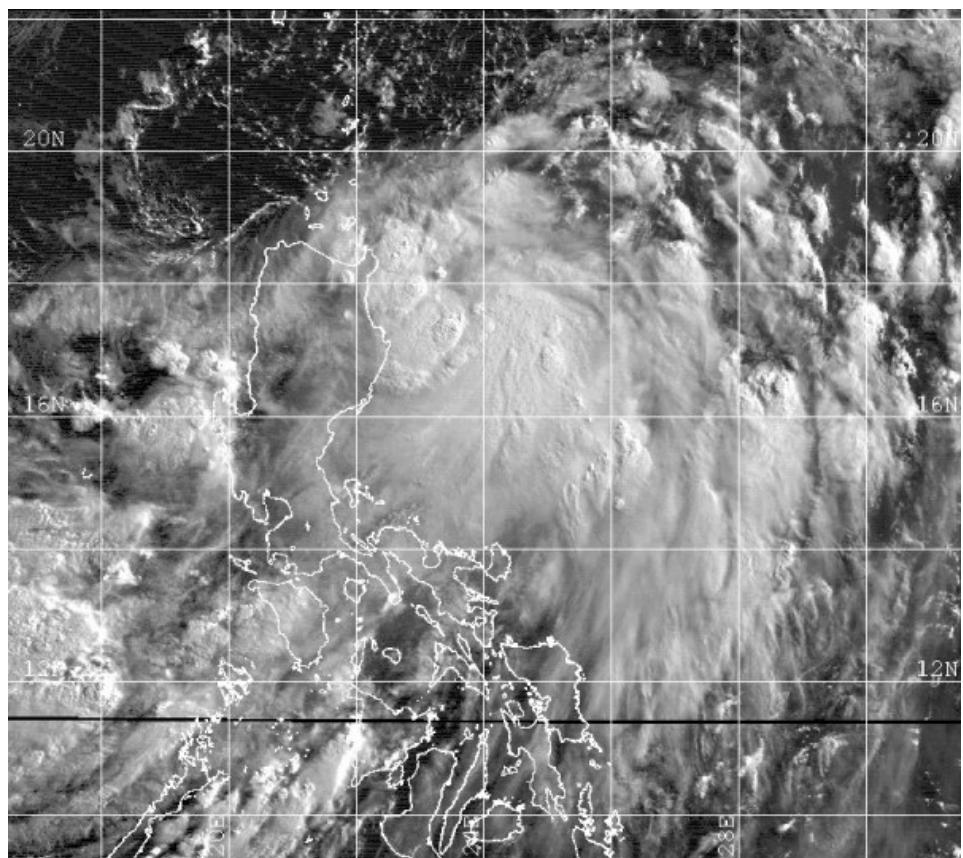


Figure 1-11W-1. 2322Z July 2000 GMS-5 visible image of the area of extensive but disorganized thunderstorm activity which developed into TS 11W.

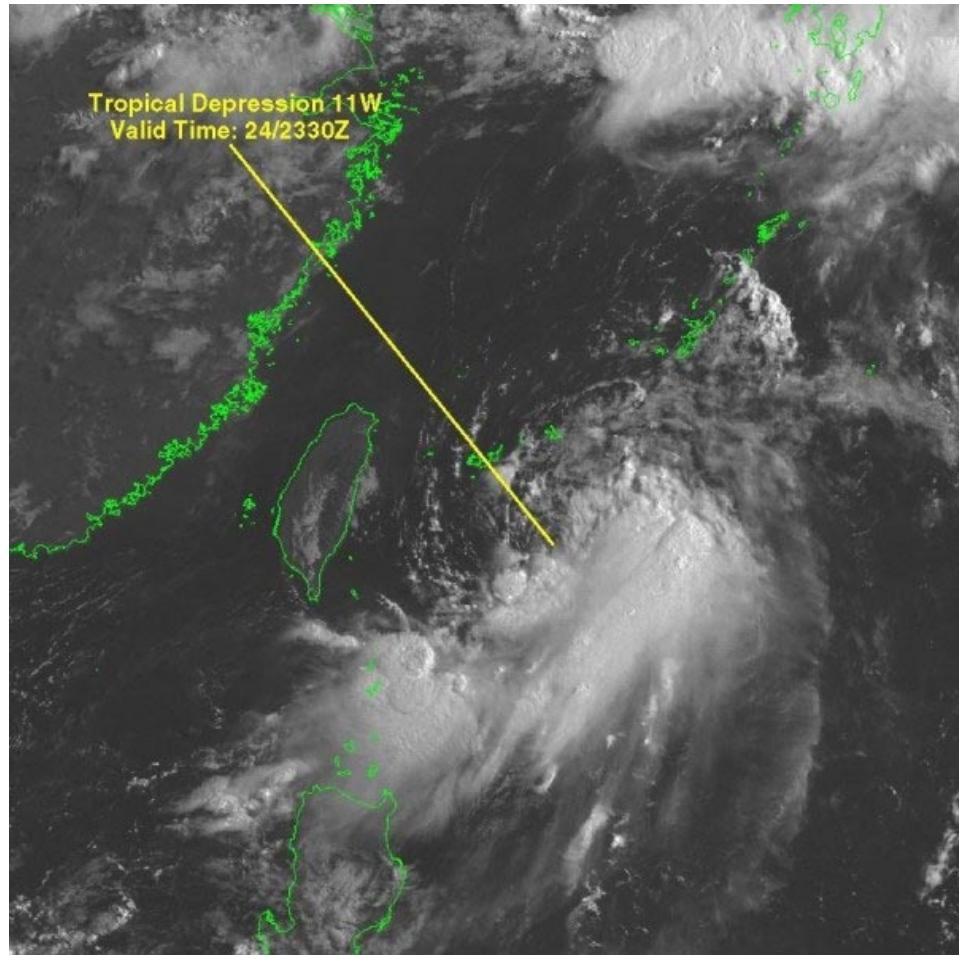


Figure 1-11W-2. 242330Z July 2000 GMS-5 visible image of TS 11W when the cyclone was located east of Taiwan. The image indicates the presence of vertical shear, with the deep convection south of the low-level circulation center.

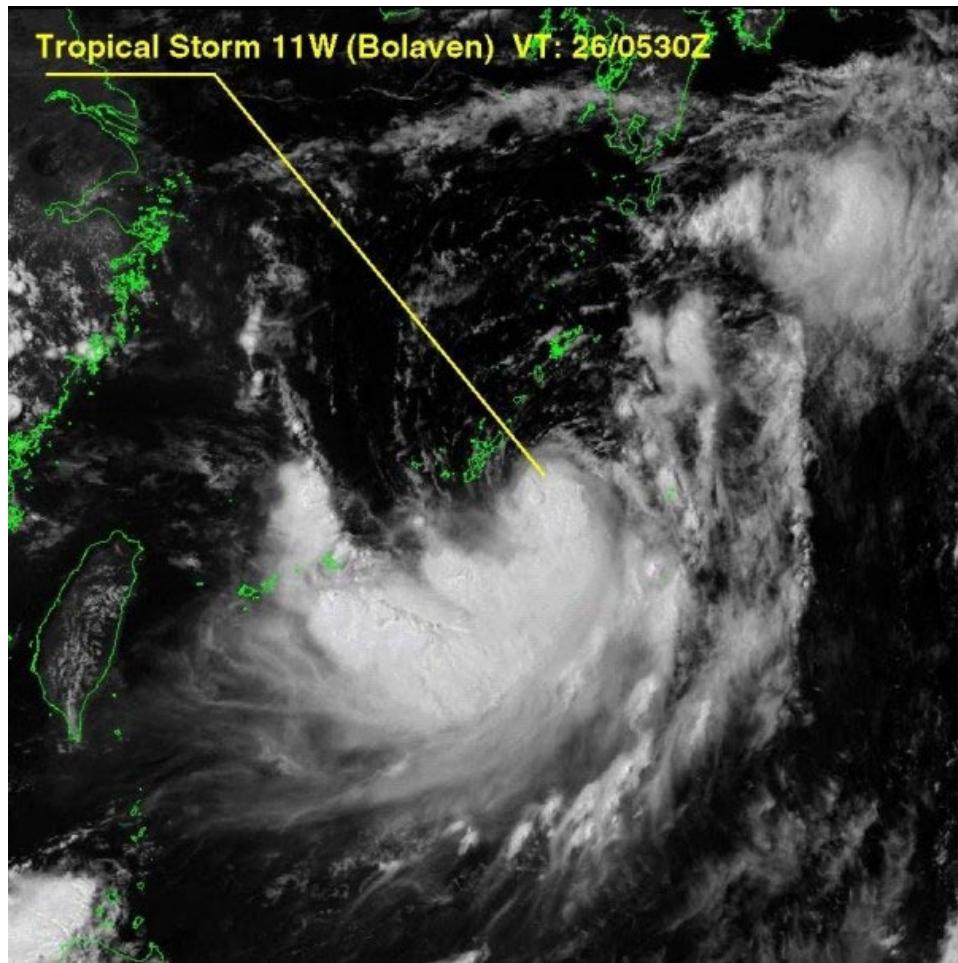


Figure 1-11W-3. 260530Z July 2000 GMS-5 visible image of TS 11W, which continues to show the deep convection displaced to the south of the low-level circulation center. At this time, the cyclone is located about 60 nm east-southeast of Okinawa, Japan.

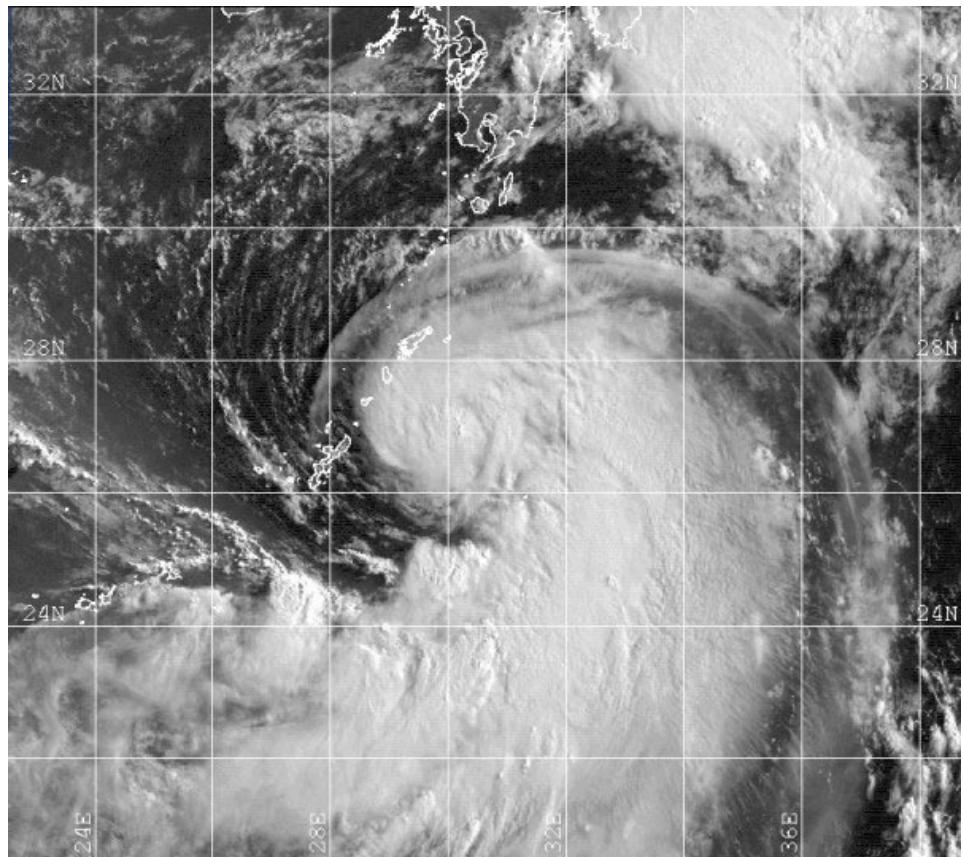


Figure 1-11W-4. 262224Z July 2000 GMS-5 visible image of TS 11W, with the convection displaced to the southeast of the circulation center. The cyclone is located about 60 nm east-northeast of Okinawa, Japan at this time.

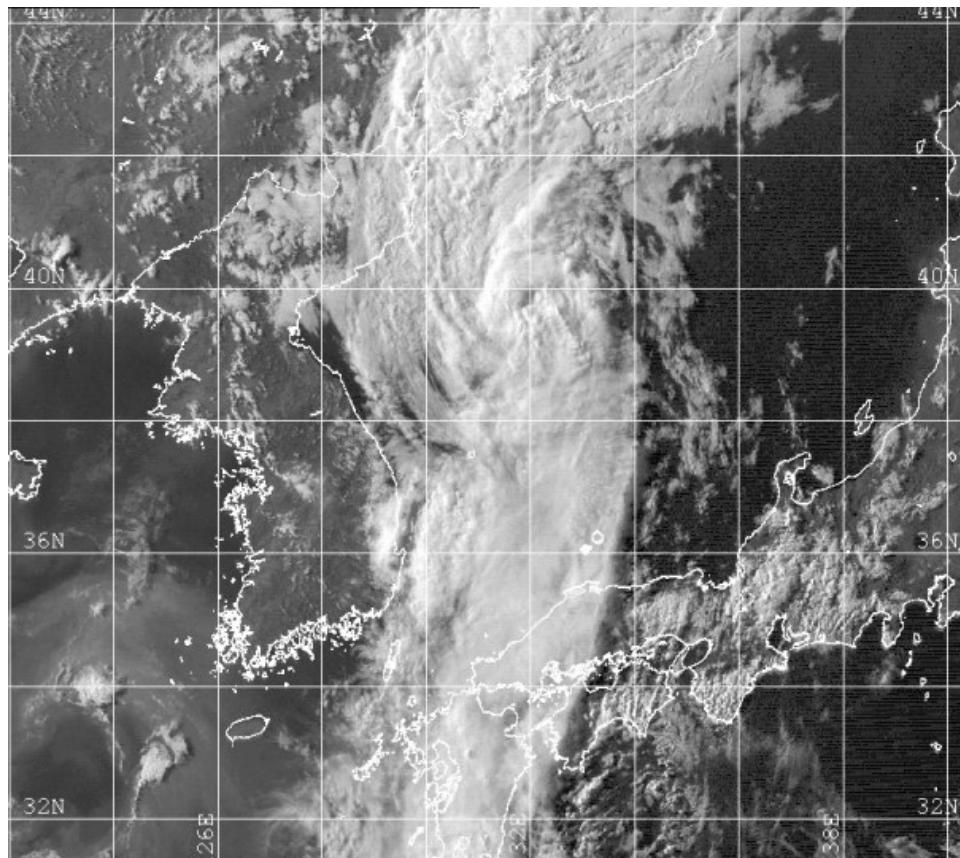
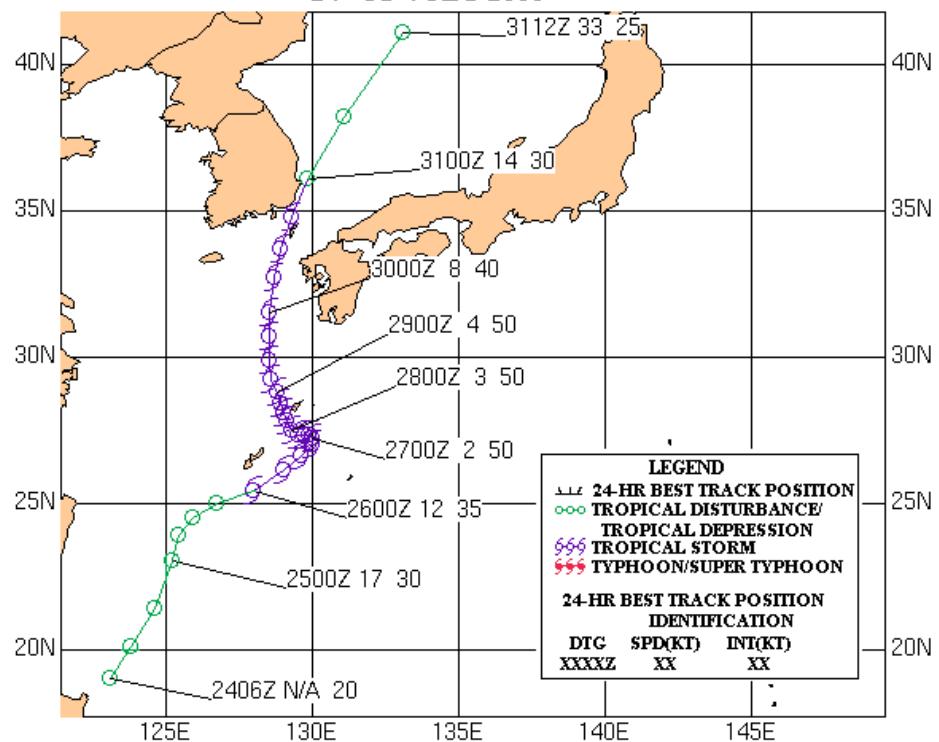


Figure 1-11W-5. 310831Z July 2000 GMS-5 visible image of TS 11W after it passed very close to the southeast coast of Korea. Convection is still evident around the circulation center, but it is not very well organized. Extensive stratus and layered clouds extending to the north and south suggest extratropical transition may be occurring.

**TROPICAL STORM 11W (BOLAVEN)**  
**24 - 31 JULY 2000**



## Tropical Storm (TS) 12W (Chanchu\*)

First Poor : 0600Z 26 Jul 00

First Fair : 0600Z 27 Jul 00

First TCFA : 1330Z 27 Jul 00

First Warning : 0000Z 28 Jul 00

Last Warning : 1800Z 29 Jul 00

Max Intensity : 40 kts, Gusts to 50 kts

Landfall : None

Total Warnings : 8

Remarks : None

\* Name assigned by RSMC Tokyo

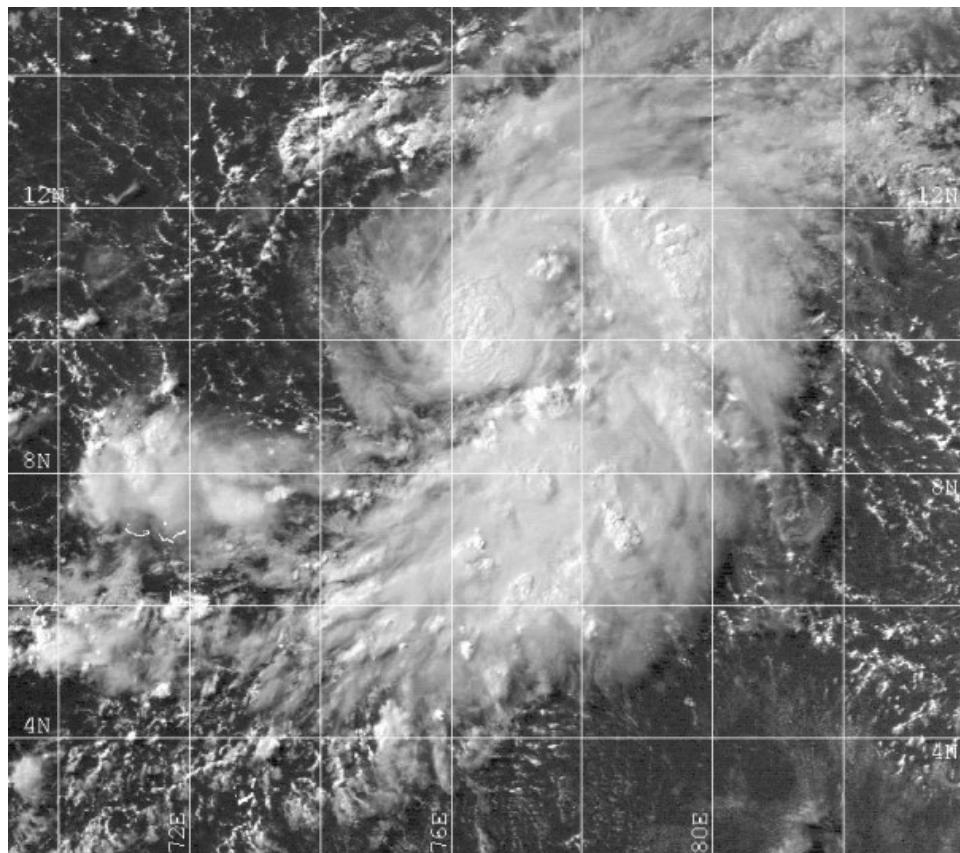


Figure 1-12W-1. 280501Z July 2000 GMS-5 visible image of TS 12W, with convection near the circulation center and a large rainband on the east side extending around the center to the south. In this image, the cyclone is located about 300 nm east-northeast of Majuro, Republic of the Marshall Islands.

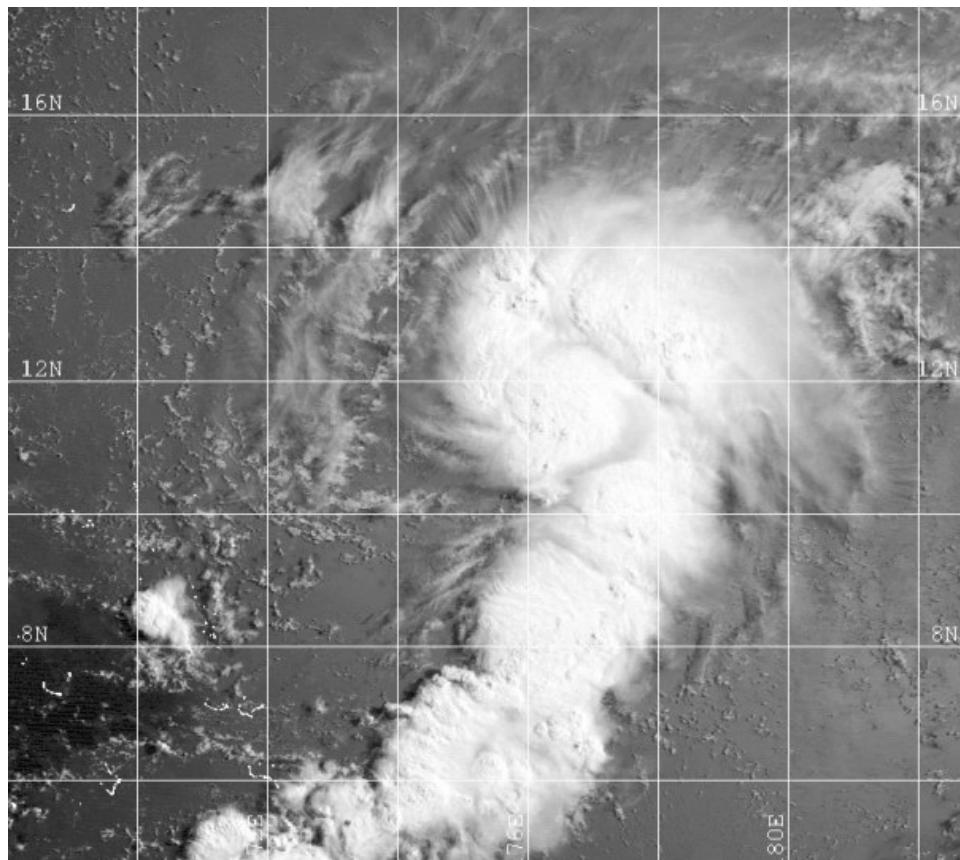


Figure 1-12W-2. 282031Z July 2000 GMS-5 visible image of TS 12W, with convection in the core and a rainband to the south.

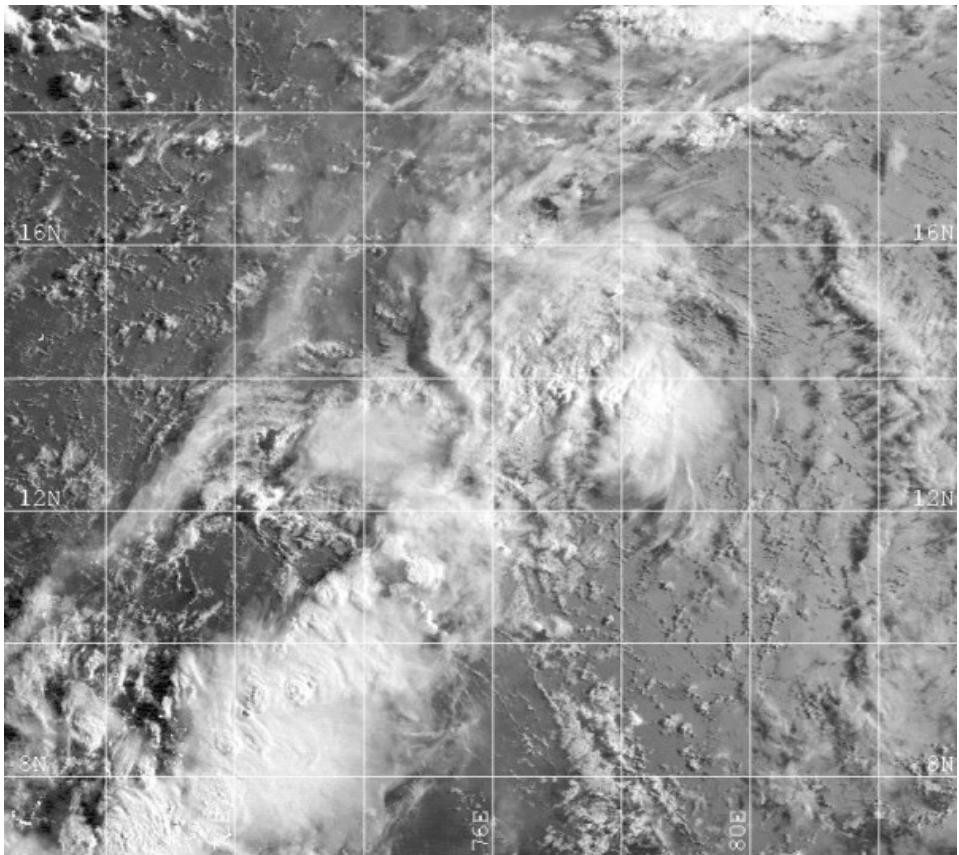
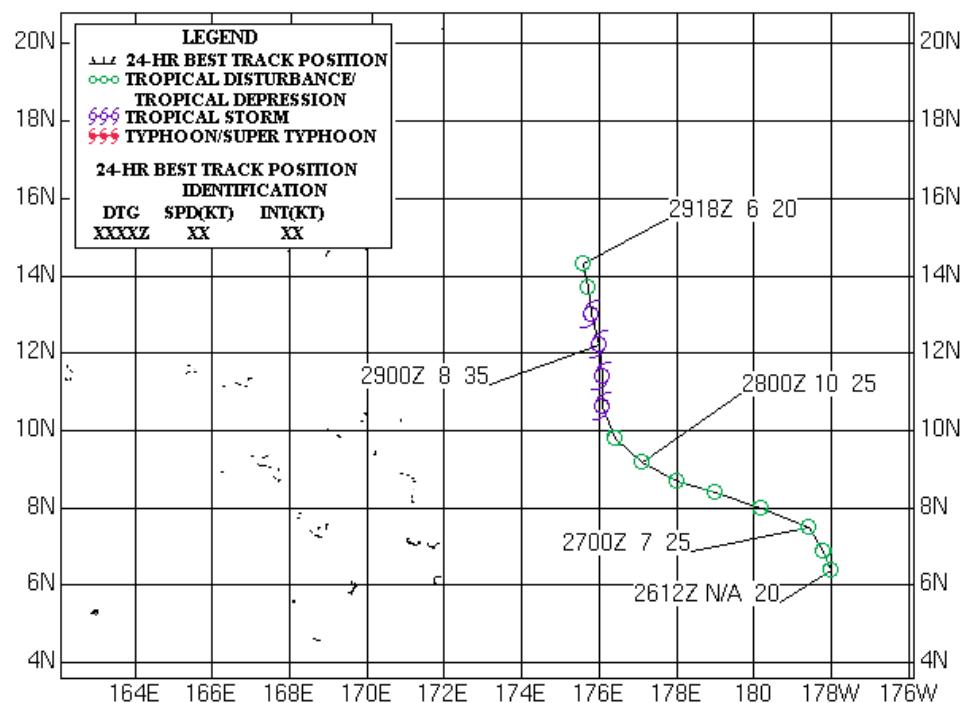


Figure 1-12W-3. 291931Z July 2000 GMS-5 visible image of the remnants of TS 12W, located about 600 nm east-southeast of Wake Island.

**TROPICAL STORM 12W (CHANCHU)**  
**28 - 29 JULY 2000**



# Typhoon (TY) 13W (Jelewat\*)

First Poor : None

First Fair : 2200Z 31 Jul 00

First TCFA : 2330Z 31 Jul 00

First Warning : 0000Z 01 Aug 00

Last Warning : 0600Z 11 Aug 00

Max Intensity : 125 kts, Gusts to 150 kts

Landfall : 1200Z 10 July 00 over China

Total Warnings : 42

Remarks:

- (1) TY 13W was the 8th named system in the western North Pacific.
- (2) TY 13W intensified from 55 knots at 1200Z on August 1 to 115 knots in 18 hours. The system reached its peak intensity of 125 knots on August 3 with a round 3 nm eye.
- (3) As the system slowly weakened, the eye diameter grew to near 20 nm in diameter. TY 13W experienced a concentric eyewall cycle near 1200Z on August 5th. Afterward, the diameter of the eye increased to 90 nm and could be easily seen in both visible and infrared imagery.
- (4) TY 13W tracked very close to Minamidaito-jima, Japan, about 180 nm east of Okinawa. The minimum sea level pressure observed was 958.9 mb at 0720Z 06 August, with a recorded peak gust of 119.5 knots.
- (5) TY 13W then brushed the northern tip of Okinawa. Observed surface winds peaked with a gust of 68 knots at Kadena Air Base.
- (6) TY 13W subsequently made landfall in China's Zhejiang province. The China Meteorological Administration estimated damages in the province and Shanghai at \$28 million.

\* Name assigned by RSMC Tokyo

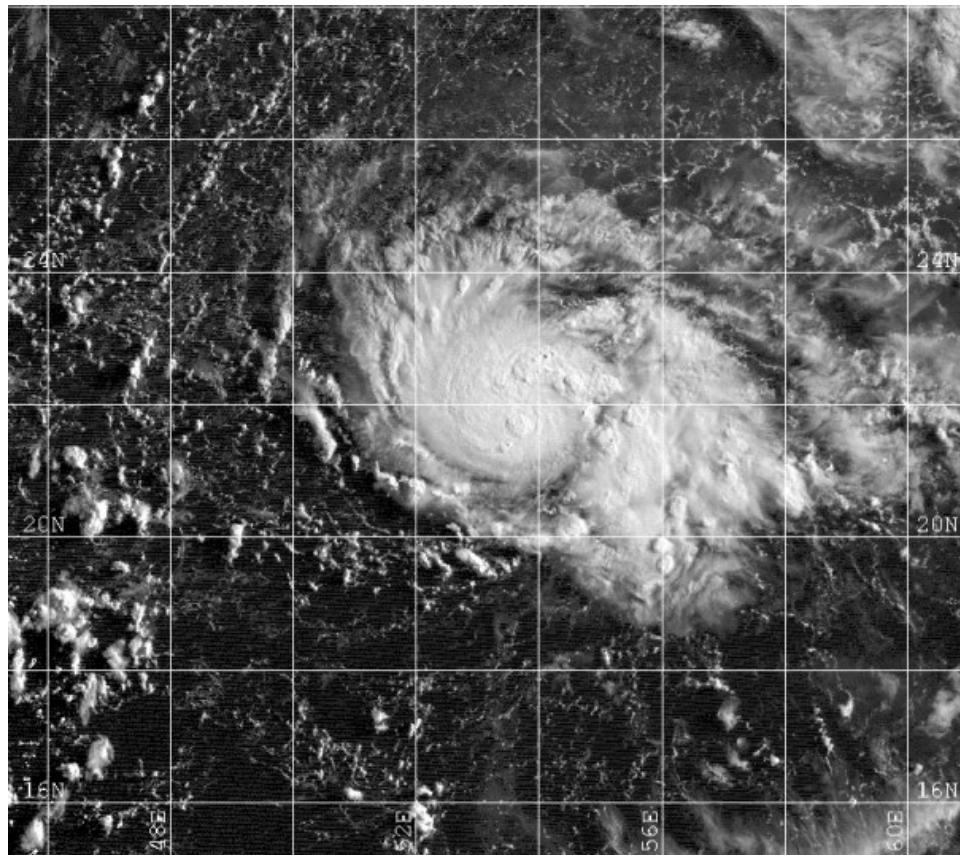


Figure 1-13W-1. 312031Z July 2000 GMS-5 visible image of TY 13W, when the cyclone was located about 750 nm east-northeast of the Mariana Islands.

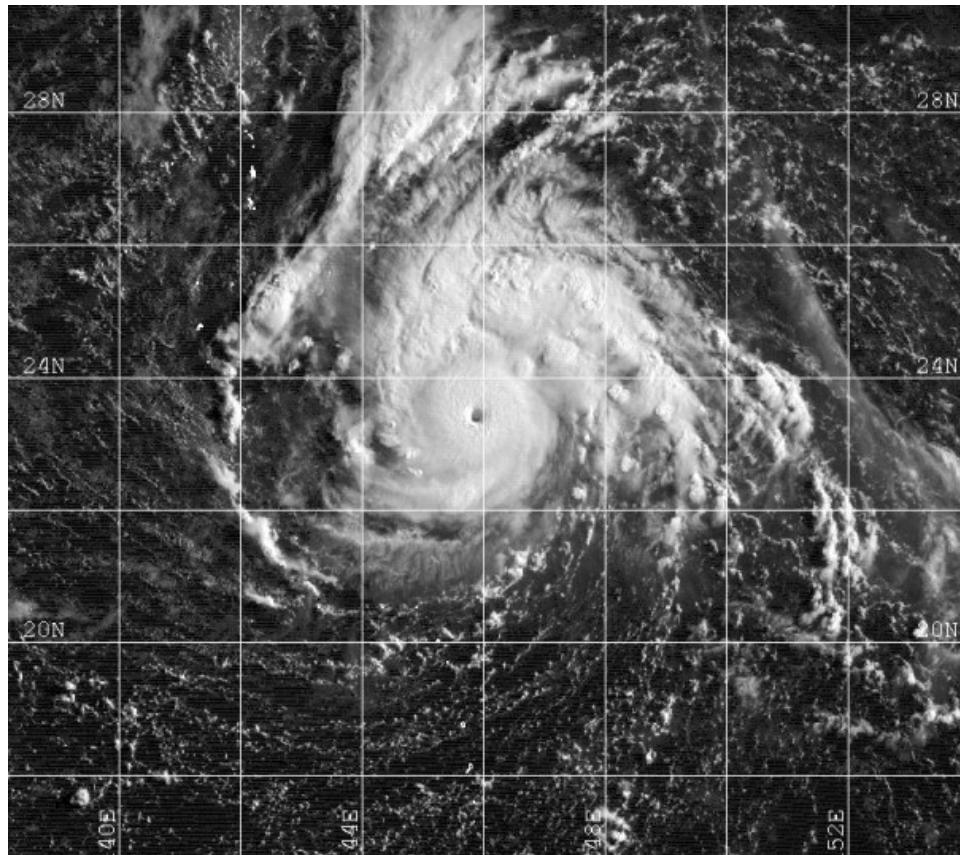


Figure 1-13W-2. 022131Z August 2000 GMS-5 visible image of TY 13W during the period of rapid intensification. At this time, the cyclone is located about 540 nm north of Saipan with a small but well-defined eye.

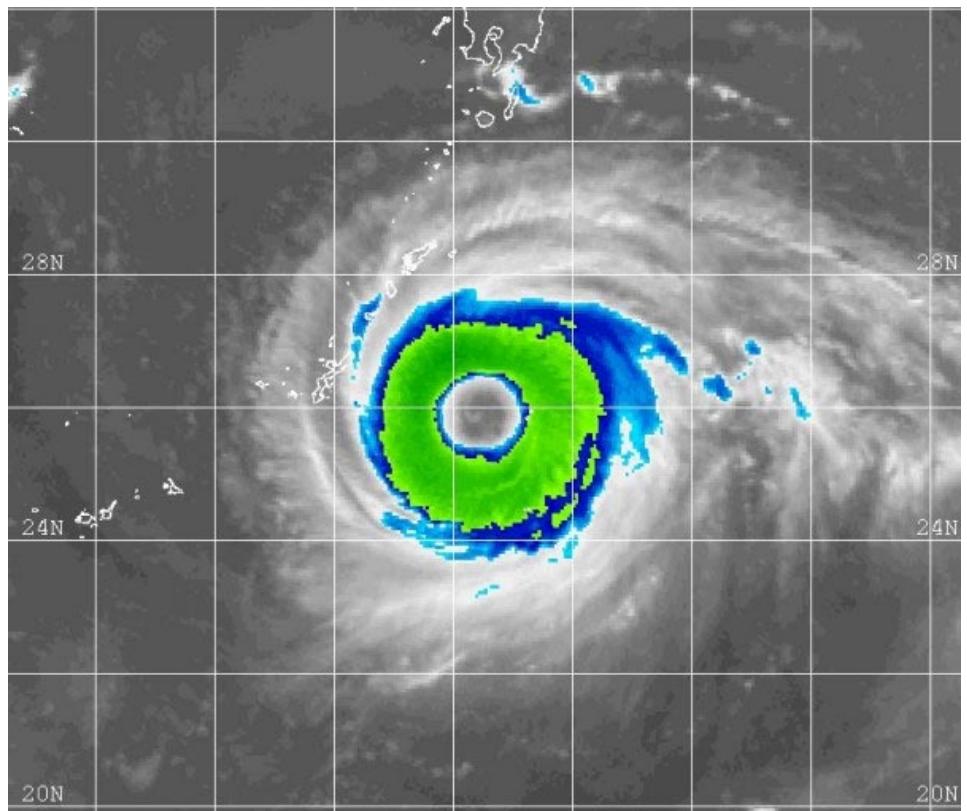


Figure 1-13W-3. 061231Z August 2000 GMS-5 enhanced infrared image of TY 13W after the cyclone completed a complex eyewall replacement cycle. Following the eyewall replacement cycle, the eye expanded to about 90 nm. At this time, the cyclone is located about 120 nm east-southeast of Okinawa.

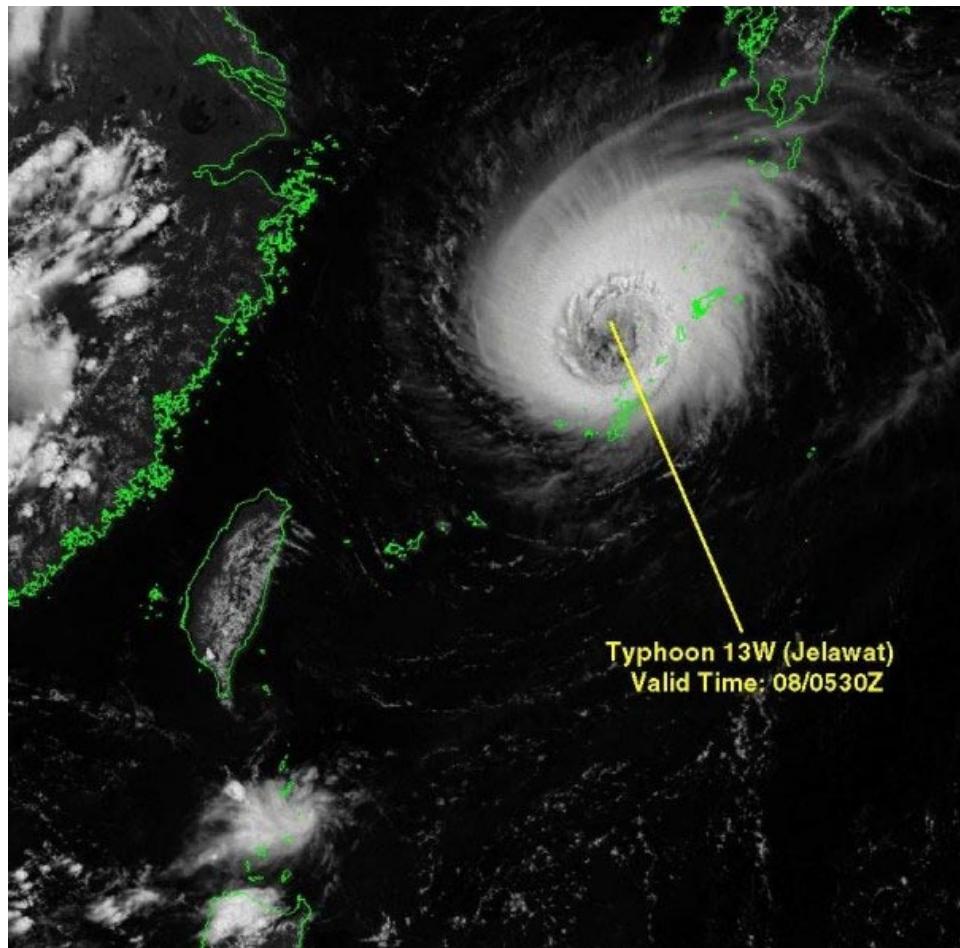


Figure 1-13W-4. 080530Z August 2000 GMS-5 visible image of TY 13W after passage through the Ryukyu Islands.

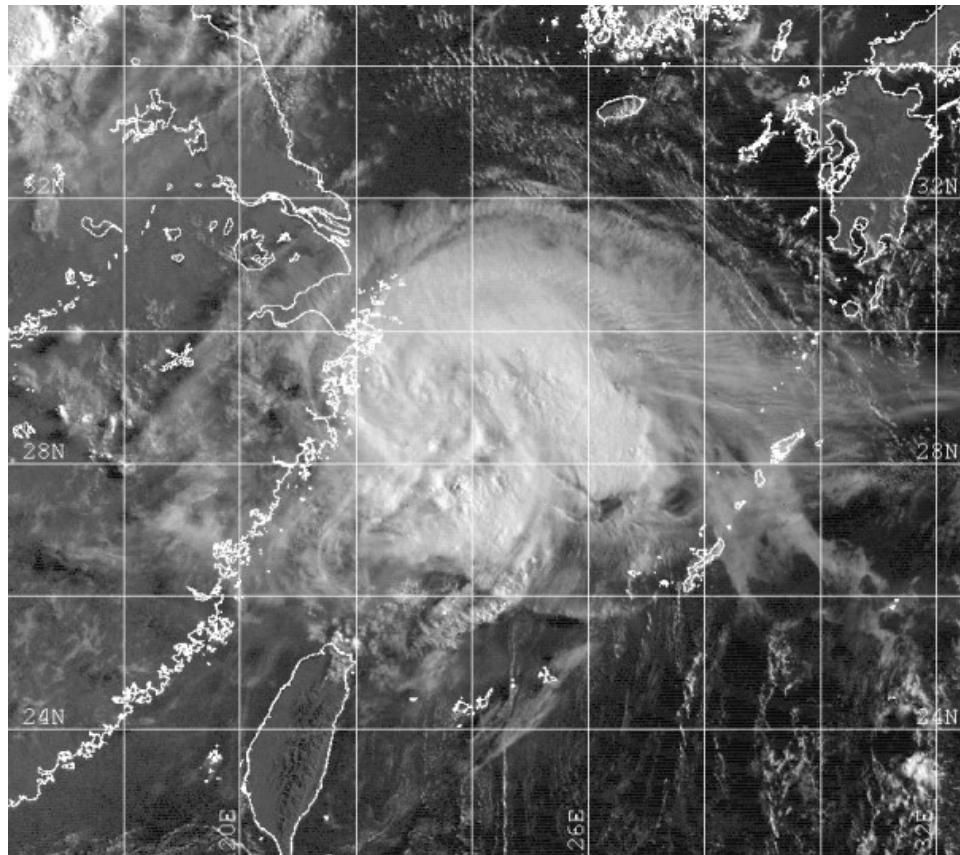
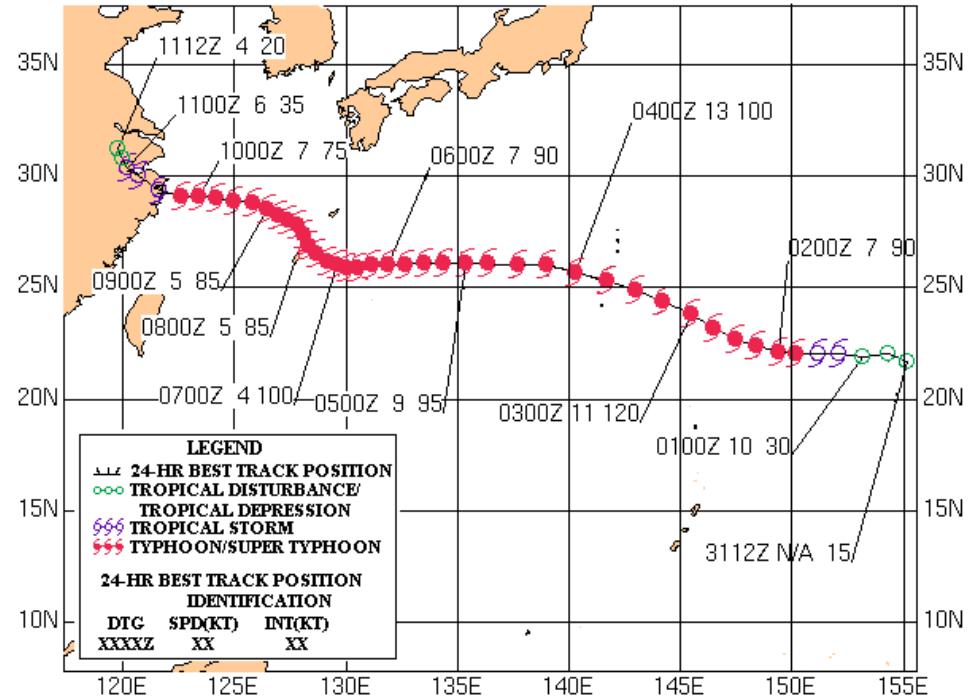


Figure 1-13W-5. 0922Z August 2000 GMS-5 visible image of TY 13W just prior to landfall over Zhejiang province. By this time, the eye of the cyclone is completely obscured and deep convection is limited to the southern periphery.

**TYPHOON 13W (JELAWAT)**  
**01 - 11 AUG 2000**



## **Tropical Depression (TD) 14W**

First Poor : 0600Z 07 Aug 00

First Fair : 0730Z 07 Aug 00

First TCFA : 0030Z 08 Aug 00

First Warning : 0600Z 08 Aug 00

Last Warning : 0000Z 10 Aug 00

Max Intensity : 30 kts, Gusts to 40 kts

Landfall : None

Total Warnings : 8

Remarks : None

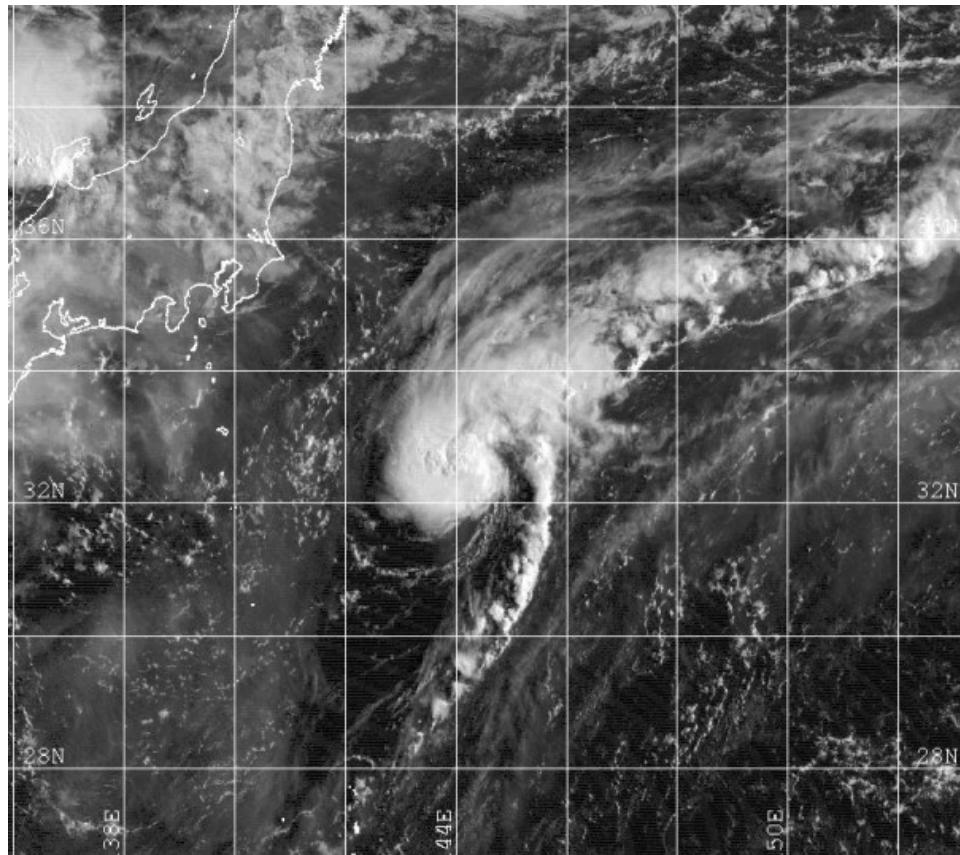
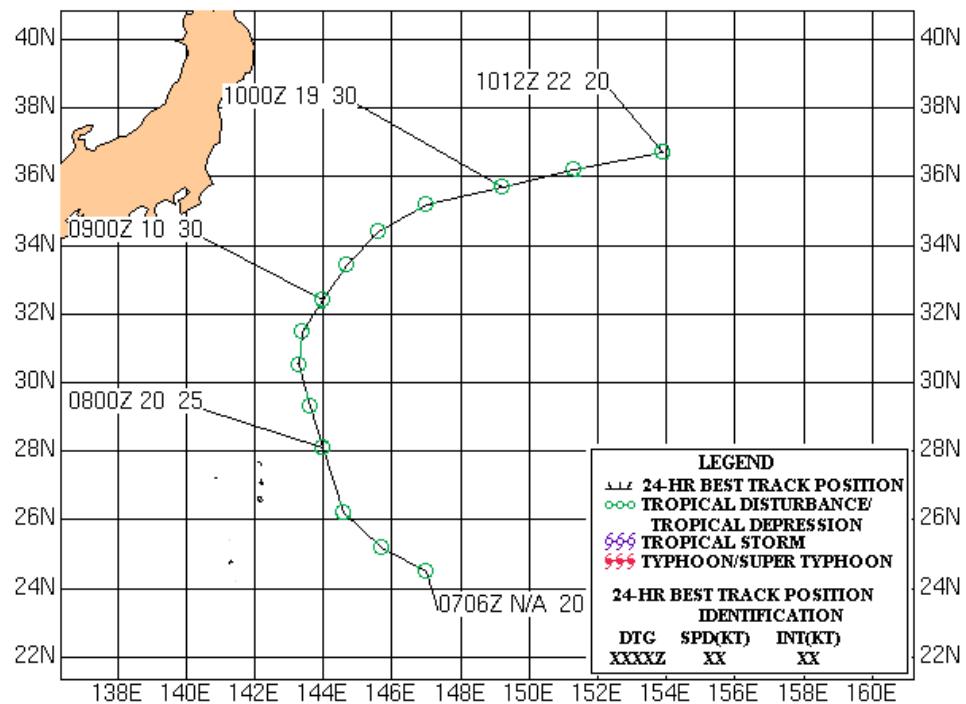


Figure 1-14W-1. 082131Z August 2000 GMS-5 visible image of TD 14W, located about 300 nm southeast of Tokyo, Japan. A central dense overcast can be seen, as well as a weak rainband extending southward.

**TROPICAL DEPRESSION 14W**  
**08 - 10 AUG 2000**



## **Typhoon (TY) 15W (Ewiniar\*)**

First Poor : 0600Z 06 Aug 00

First Fair : 0100Z 08 Aug 00

First TCFA : 0300Z 09 Aug 00

First Warning : 0600Z 09 Aug 00

Last Warning : 0600Z 19 Aug 00

Max Intensity : 75 kts, Gusts to 90 kts

Landfall : None

Total Warnings : 41

Remarks :

- (1) This system tracked in a very small, slow cyclonic loop east of Honshu, Japan, in a region of weak to moderate vertical shear and little steering.

\* Name assigned by RSMC Tokyo

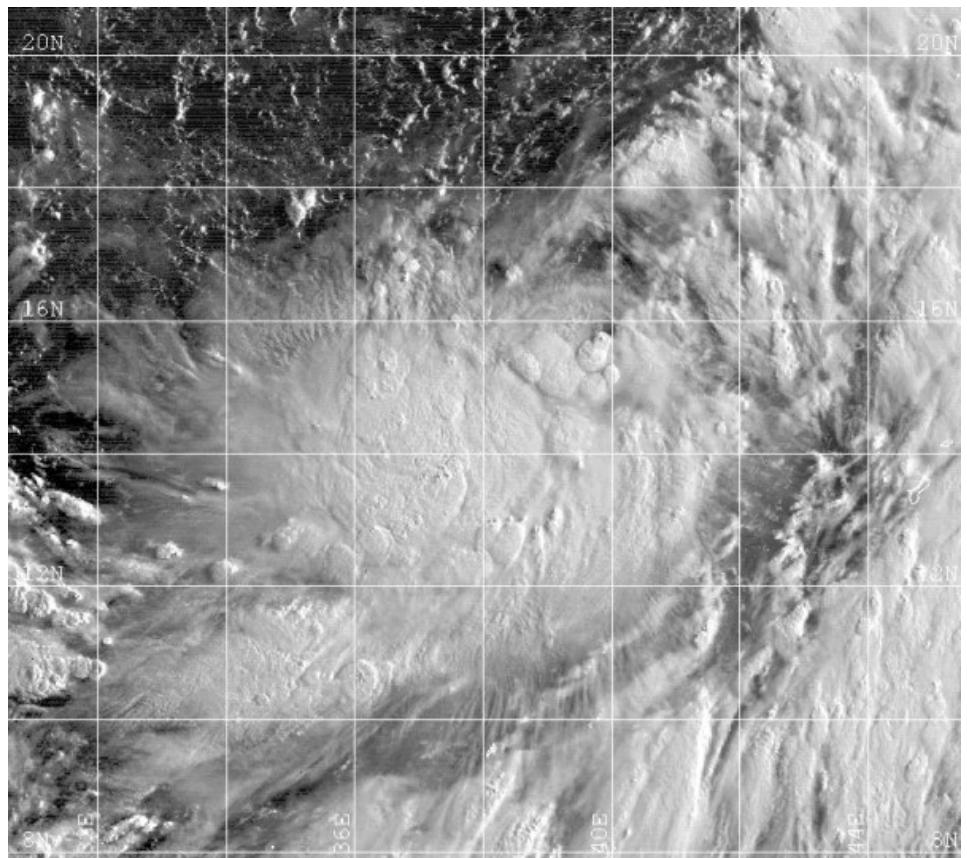


Figure 1-15W-1. 092131Z August 2000 GMS-5 visible image of TY 15W, located about 300 nm west of the Northern Mariana Islands. Convection is massed near the circulation center.

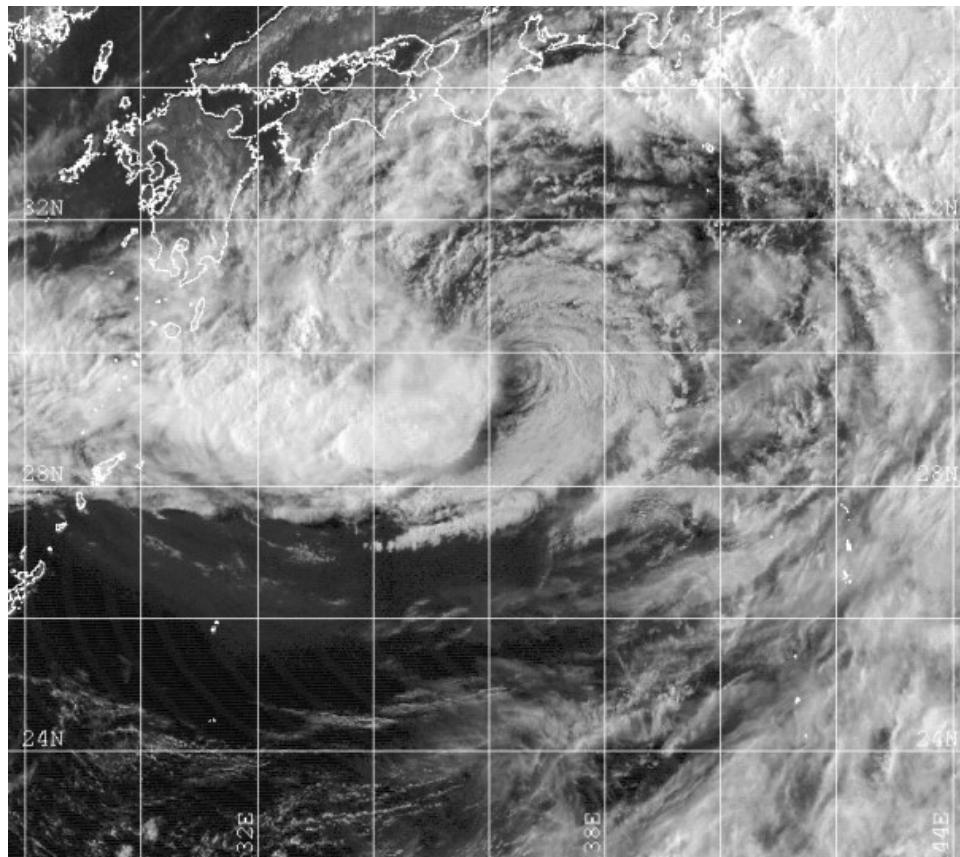


Figure 1-15W-2. 120731Z August 2000 GMS-5 visible image of TY 15W, located about 240 nm south of Honshu. At this time, vertical shear is evident, with the deep convection displaced to the west of the exposed low-level circulation center.

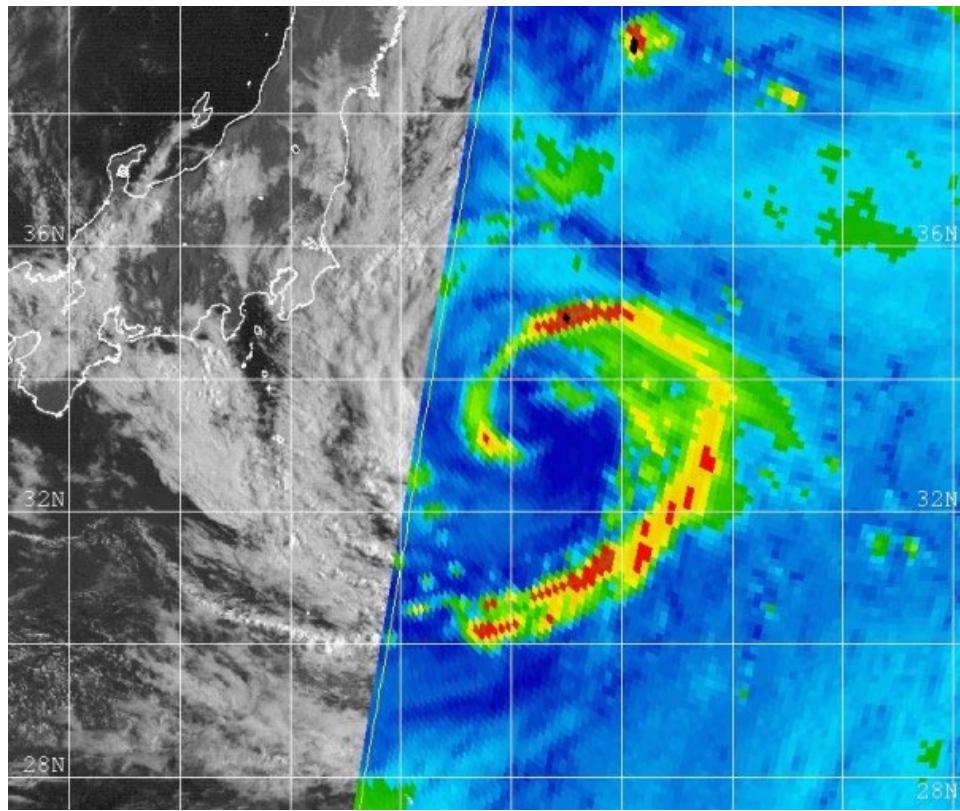


Figure 1-15W-3. 132306Z August 2000 SSMI 85 GHz image of TY 15W, located about 180 nm east-southeast of Tokyo, Japan. The spiral character of the open eyewall and connected rainband is evident in this image.

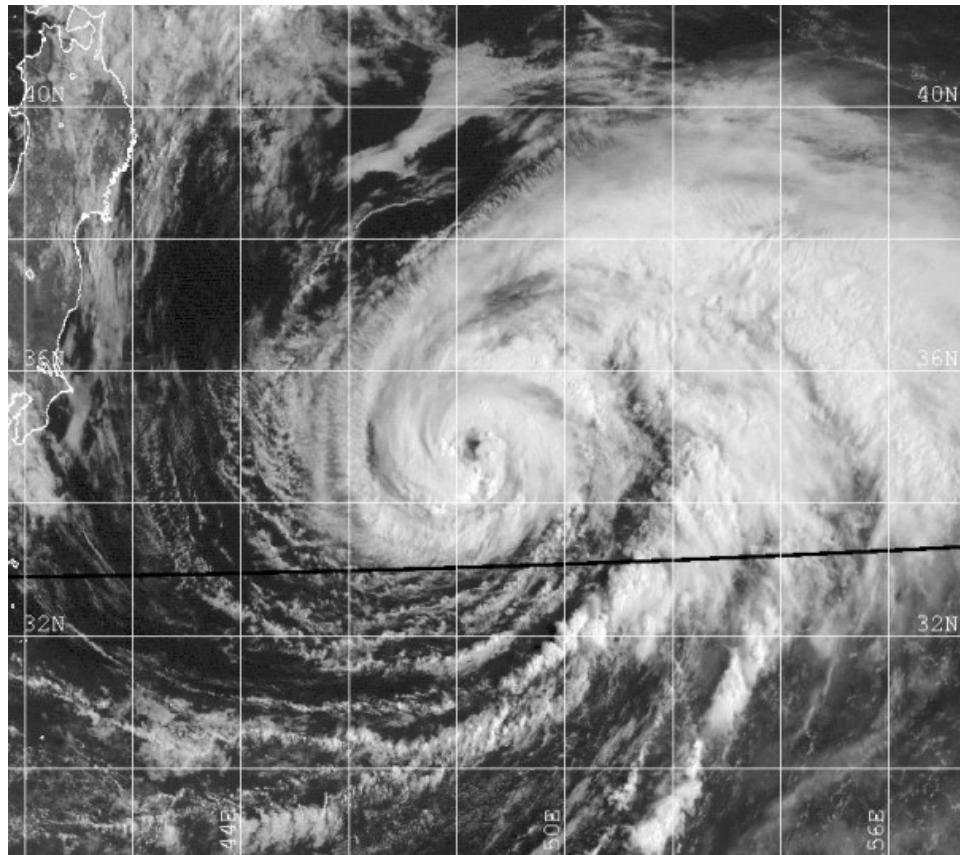


Figure 1-15W-4. 1422Z August 2000 GMS-5 visible image of TY 15W, located about 500 nm east of Tokyo, Japan, with a clear eye, complete eyewall, and banding features on the northeast and east sides of the cyclone.

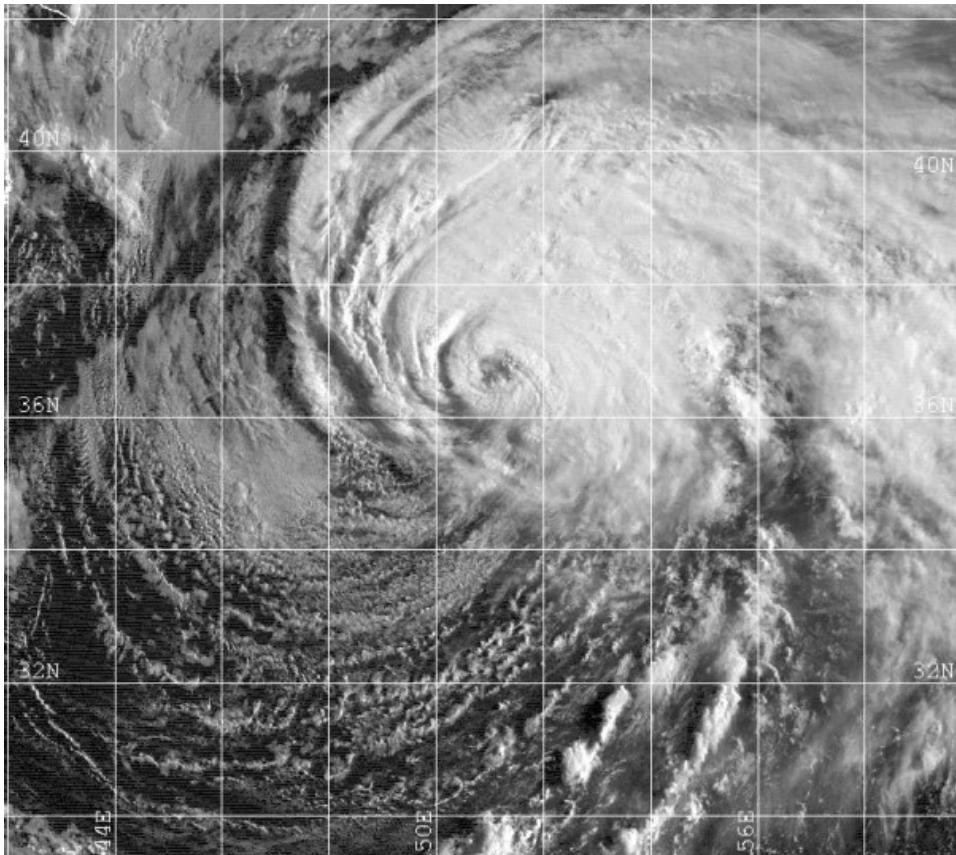
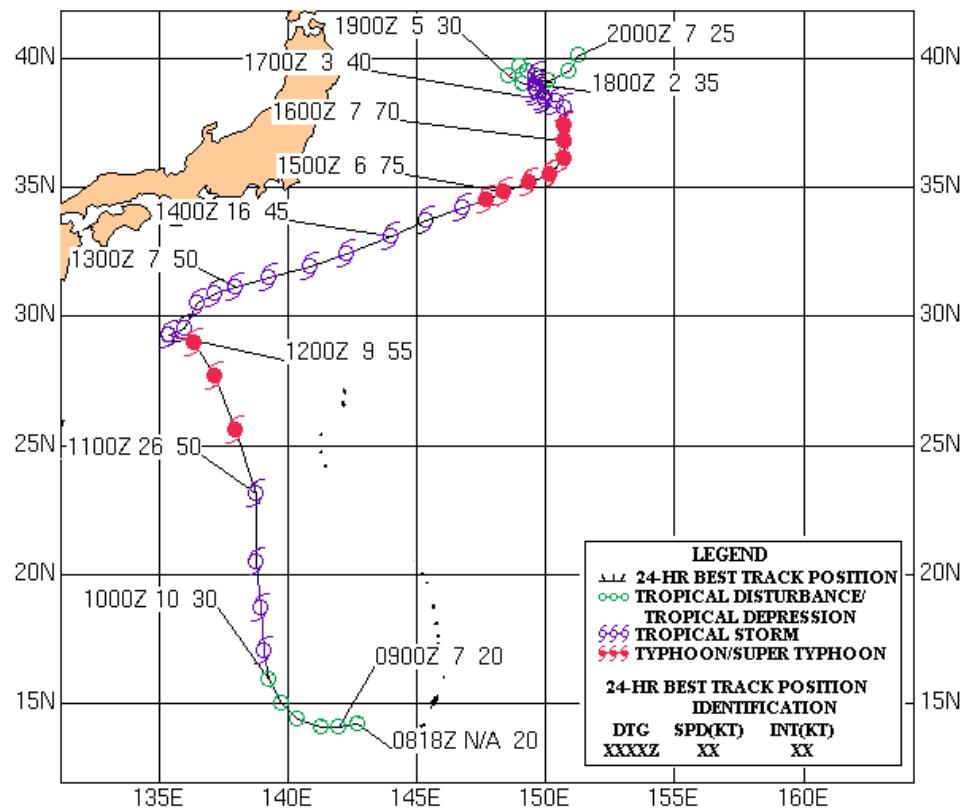


Figure 1-15W-5. 1520Z August 2000 GMS-5 visible image of TY 15W, located about 650 nm east of Tokyo, Japan. At this time, vertical shear is evident with the low-level circulation center partially exposed and the deep convection displaced to the northeast.

**TYPHOON 15W (EWINIAR)**  
**09 - 19 AUG 2000**



## **Tropical Storm (TS) 16W (Wene\*)**

First Poor : None

First Fair : None

First TCFA : 0200Z 15 Aug 00

First Warning : 0900Z 15 Aug 00

Last Warning : 0900Z 17 Aug 00

Max Intensity : 55 kts, Gusts to 70 kts.

Landfall : None

Total Warnings : 9 (3 by JTWC, 6 by CPHC and NPMOC Pearl Harbor)

Remarks : None

\* Name assigned by CPHC Honolulu

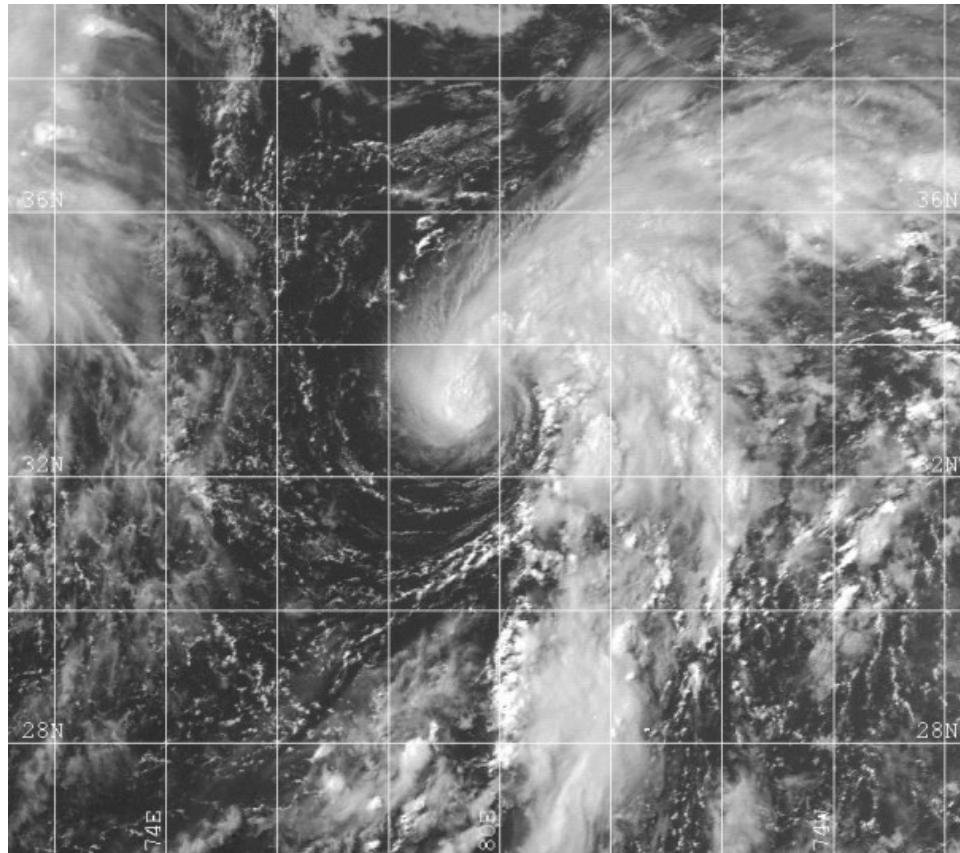


Figure 1-16W-1. 150424Z August 2000 GMS-5 visible image of TS 16W, which shows the cyclone with central convection connected to a broad rain band on the eastern side. Low-level cloud bands can also be seen to the south and west.

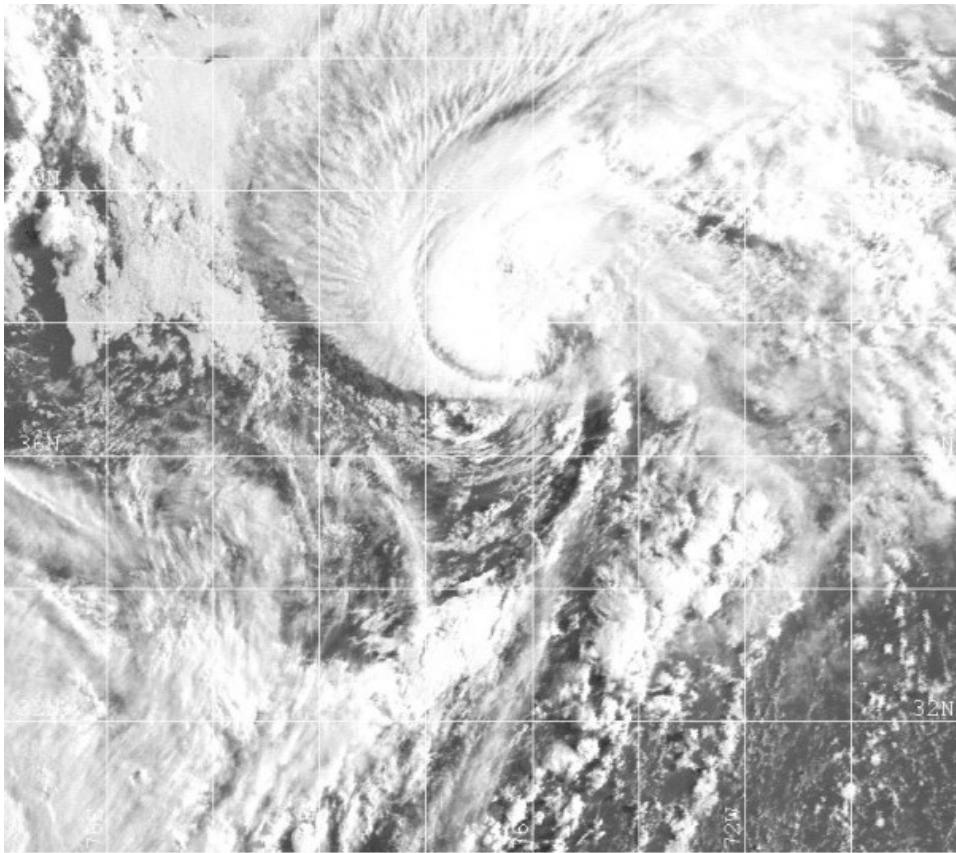
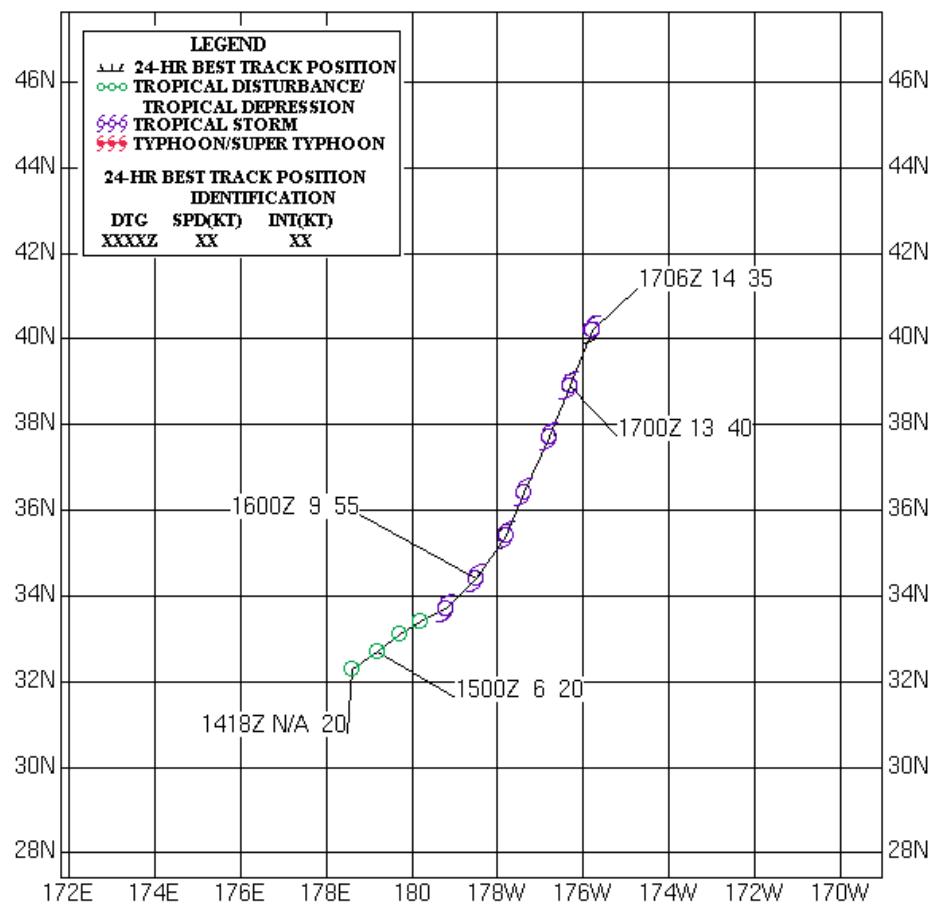


Figure 1-16W-2. 161831Z August 2000 GMS-5 visible image of TS 16W, located about 15 degrees south of the Aleutian Islands with a partially exposed low-level circulation center south of the deep convection.

**TROPICAL STORM 16W (WENE)**  
**15 - 17 AUG 2000**



## **Tropical Depression (TD) 17W**

First Poor : 0000Z 16 Aug 00

First Fair : 0000Z 17 Aug 00

First TCFA : None

First Warning : 1800Z 17 Aug 00

Last Warning : 0000Z 19 Aug 00

Max Intensity : 25 kts, Gusts to 35 kts

Landfall : None

Total Warnings : 6

Remarks : None

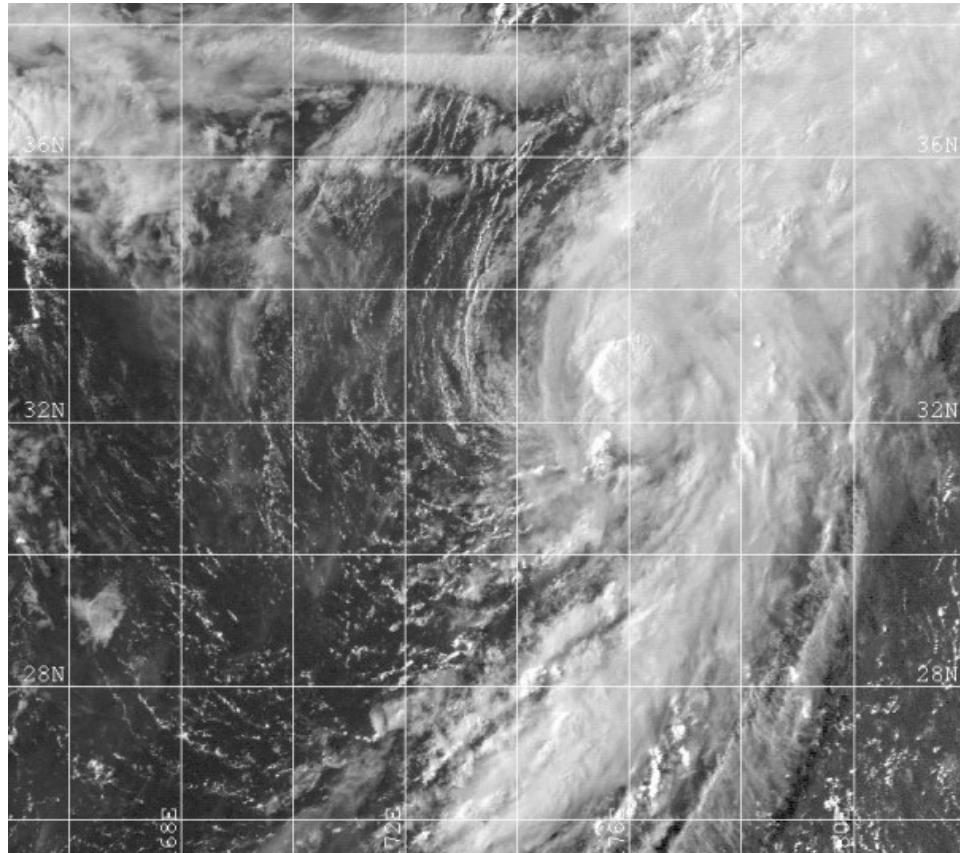
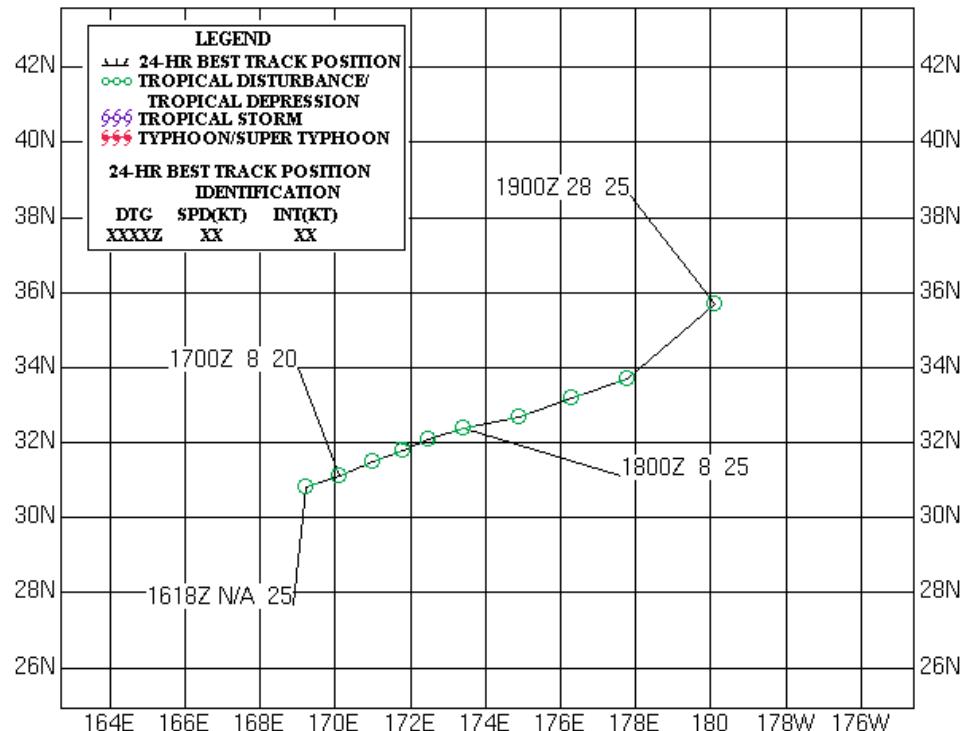


Figure 1-17W-1. 180531Z August 2000 GMS-5 visible image of TD 17W, when the cyclone was located 480 nm northwest of Midway Island. At this time, TD 17W is undergoing extra-tropical transition, with the deep convection displaced about 35 nm to the east of the low-level circulation.

**TROPICAL DEPRESSION 17W**  
**17 - 19 AUG 2000**



# **Super Typhoon (STY) 18W (Bilis\*)**

First Poor : 1730Z 15 Aug 00

First Fair : 0000Z 16 Aug 00

First TCFA : 0300Z 18 Aug 00

First Warning : 0600Z 18 Aug 00

Last Warning : 0000Z 24 Aug 00

Max Intensity : 140 kts, Gusts to 170 kts

Landfall : 1400Z 22 Aug 00 over Taiwan, 0300Z 23 Aug 00 over China

Total Warnings : 24

Remarks:

- (1) STY 18W intensified from 90 knots at 1200Z on August 20 to 140 knots in 30 hours, just prior to making landfall over Taiwan.
- (2) The center of STY 18W passed over the coast of southern Taiwan about 1400Z on August 22, then moved inland. Reports indicated 14 fatalities, 80 injured, 400 houses destroyed, and power disruption to 600,000 homes. This was the second typhoon to affect Taiwan in 2000. The island's agricultural, fishery, and forestry industries experienced damages of \$133.5 million.
- (3) STY 18W made final landfall near Jinjian, Fujian province, China. The China Meteorological Administration reported 57 fatalities, 1077 wounded or missing, and economic losses of \$534 million. Quanzhou recorded 220 mm (8.7 inches) of rain. Tornadoes associated with this cyclone were reported to have struck four villages near Yueqing, destroying 20 buildings and damaging at least 130 others.

\* Name assigned by RSMC Tokyo

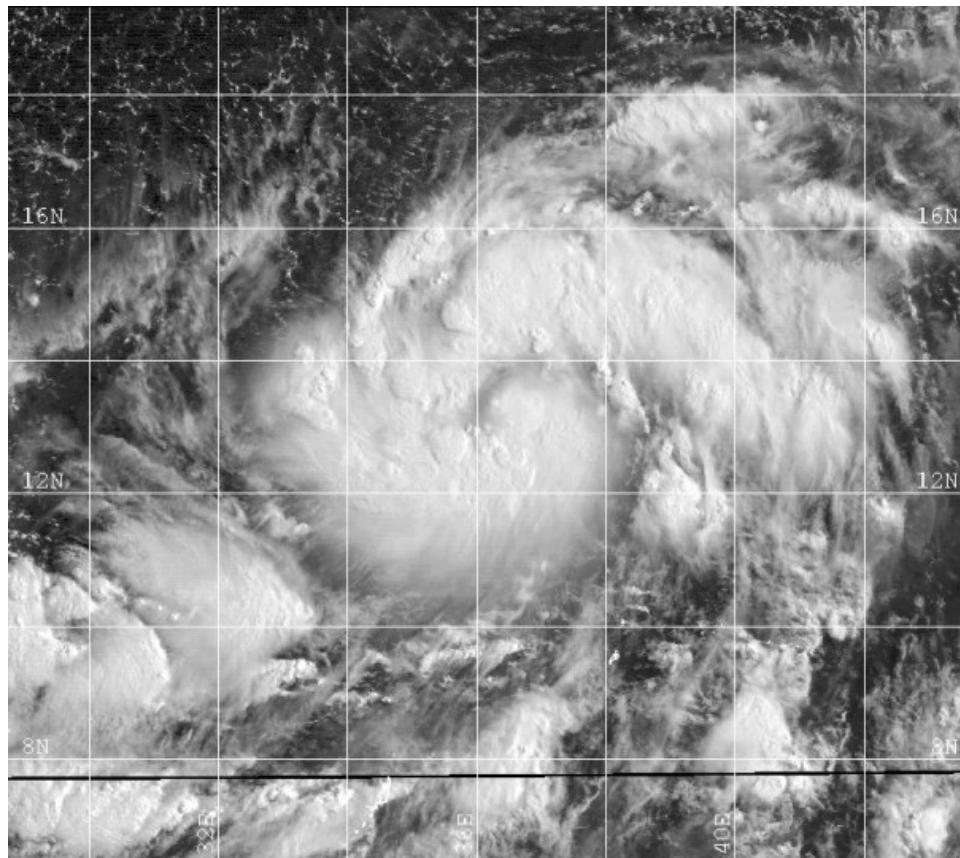


Figure 1-18W-1. 182301Z August 2000 GMS-5 visible image of STY 18W, when the cyclone was located about 260 nm north-northwest of Yap at tropical storm intensity.

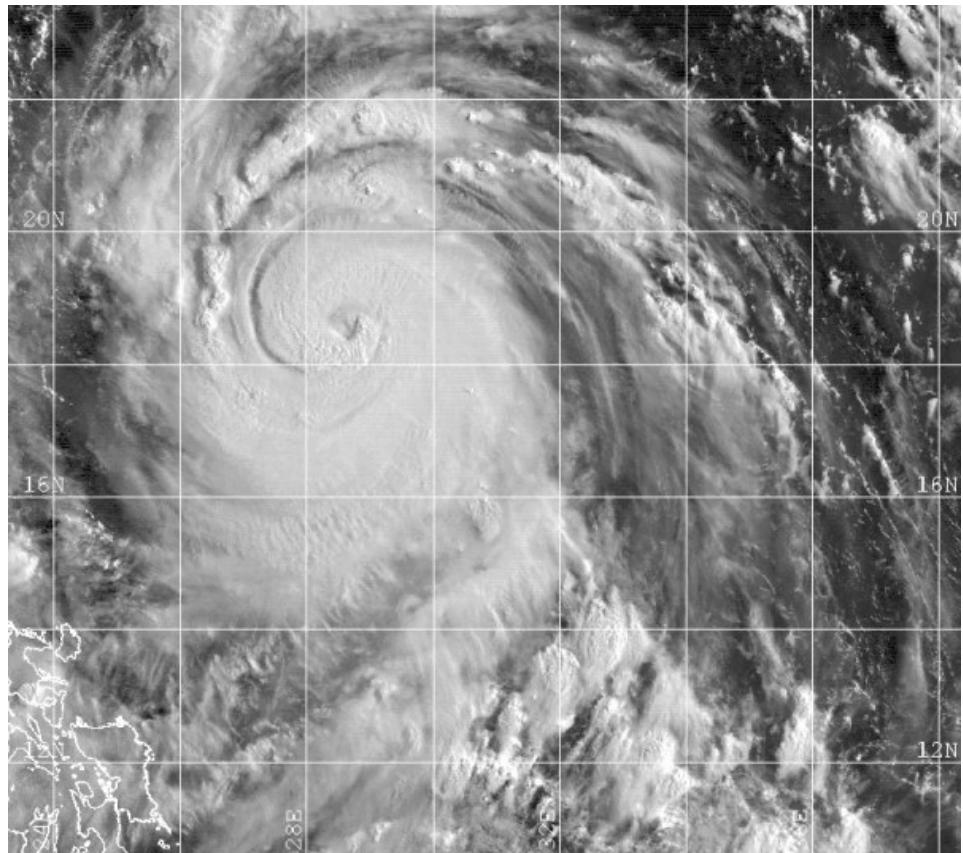


Figure 1-18W-2. 2022Z August 2000 GMS-5 visible image of STY 18W, located about 350 nm east of Luzon, Philippines, with a developing eye and deep convection wrapped completely around the center.

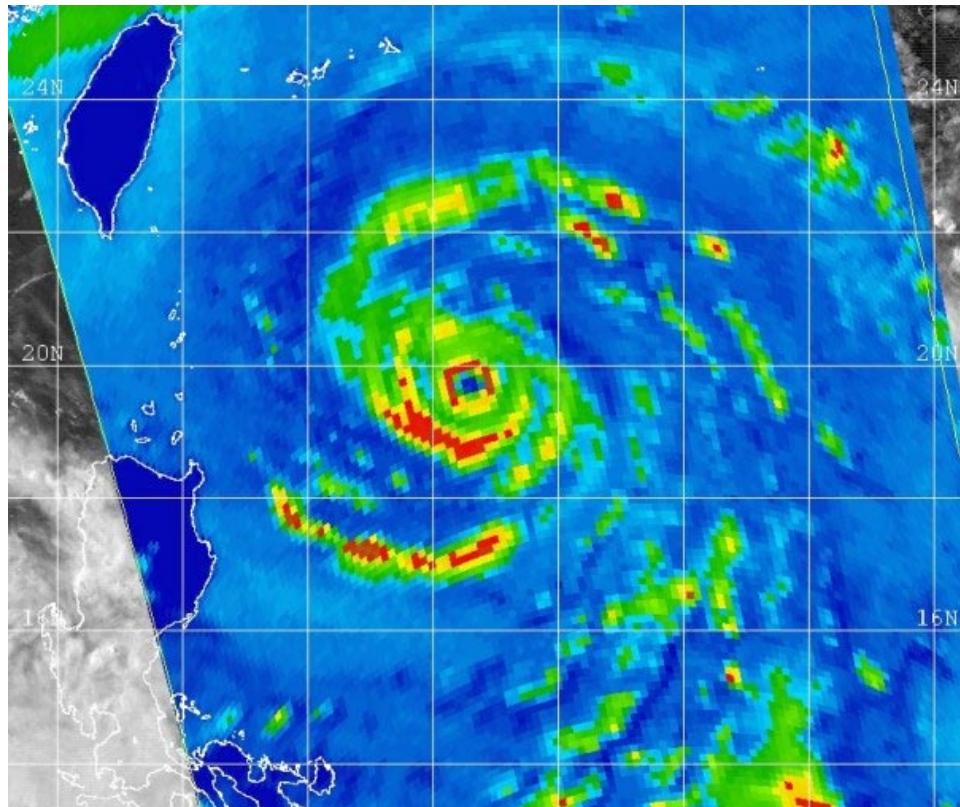


Figure 1-18W-3. 210831Z August 2000 SSMI 85 GHz image of STY 18W just prior to reaching super typhoon intensity. At this time, the cyclone is approximately 400 nm southeast of Taiwan, with concentric eyewalls and strong rainbands to the north and south.

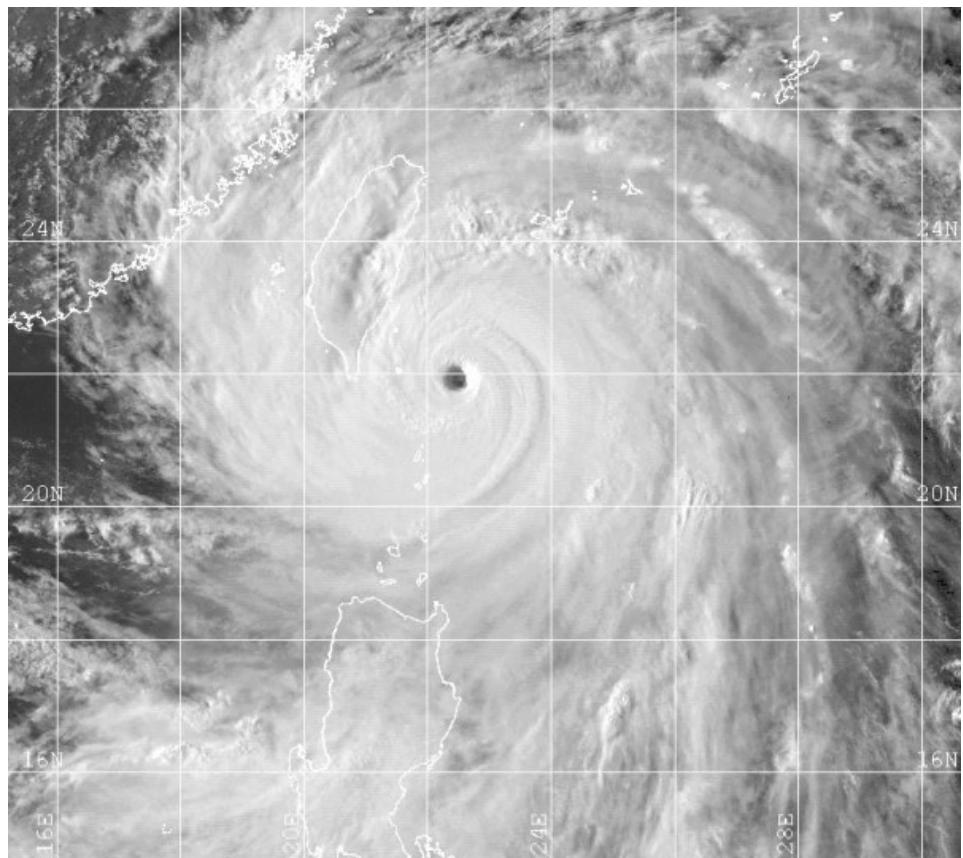


Figure 1-18W-4. 220831Z August 2000 GMS-5 visible image of STY 18W, located 120 nm south-east of Taiwan with a well-defined eye.

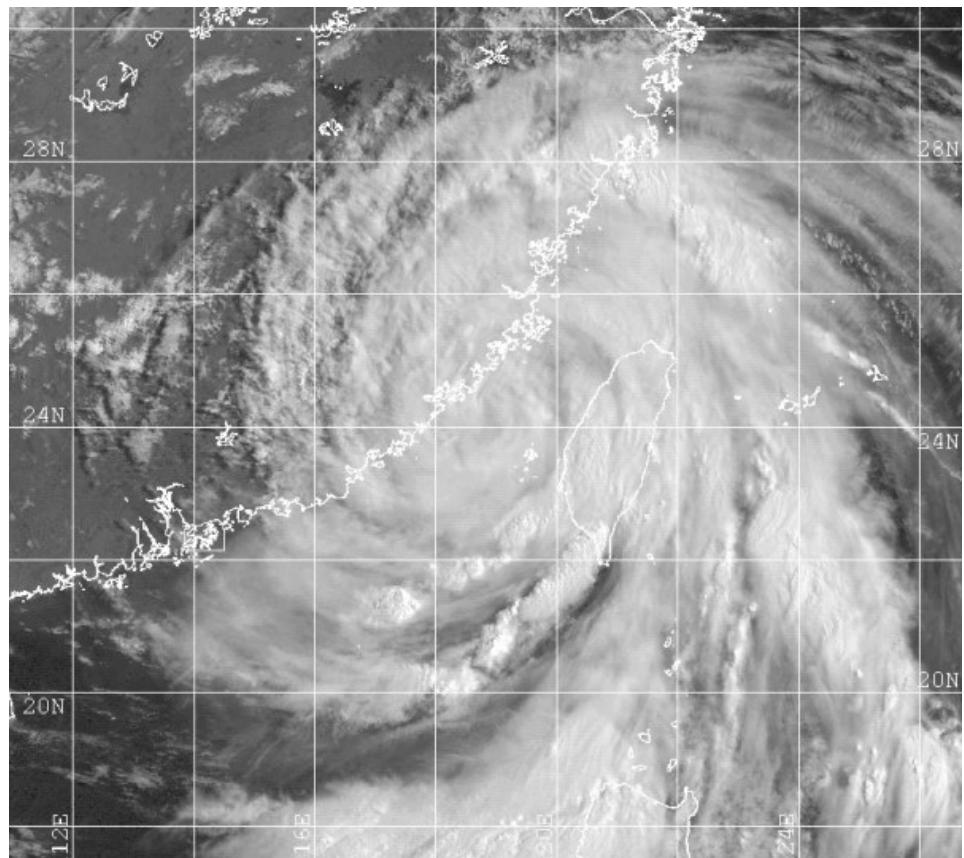
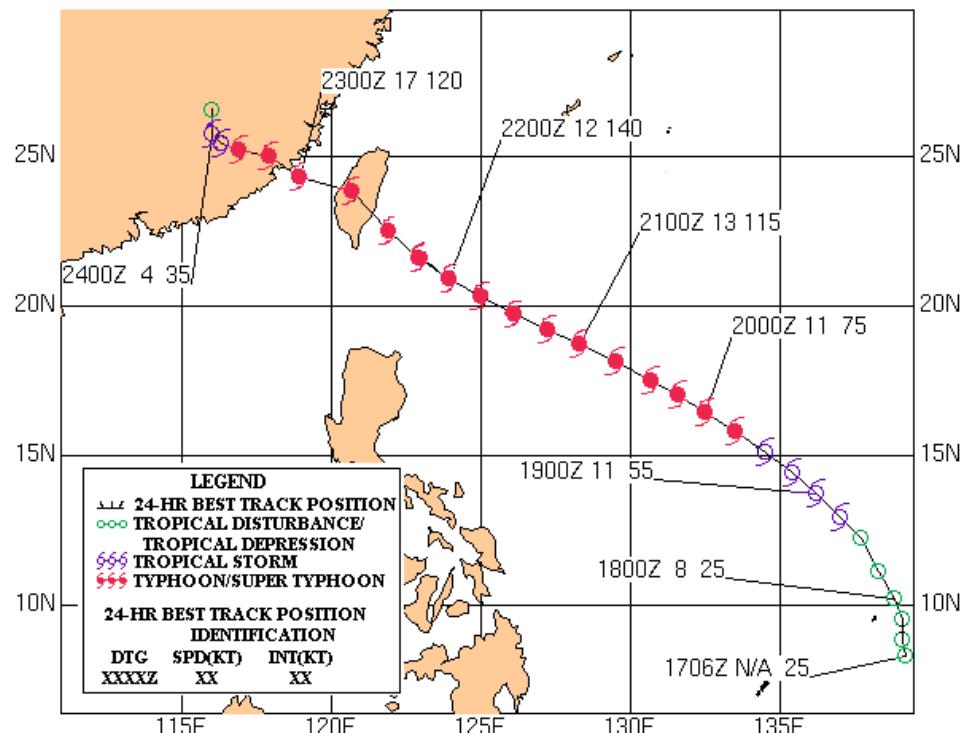


Figure 1-18W-5. 2223Z August 2000 GMS-5 visible image of STY 18W, just prior to making landfall near Quanzhou, China.

**SUPER TYPHOON 18W (BILIS)**  
**18 - 24 AUG 2000**



## **Tropical Storm (TS) 19W (Kaemi\*)**

First Poor : 0000Z 17 Aug 00

First Fair : 1530Z 18 Aug 00

First TCFA : 0000Z 19 Aug 00

First Warning : 0600Z 20 Aug 00

Last Warning : 0000Z 23 Aug 00

Max Intensity : 45 kts, Gusts to 55 kts

Landfall : 0600Z 22 Aug 00 over Da Nang, Vietnam

Total Warnings : 12

Remarks:

- (1) Reuters News reported 6 deaths, two capsized tour boats in Halong Bay, and several sunken fishing vessels after TS 19W struck central Vietnam near Da Nang.

\* Name assigned by RSMC Tokyo

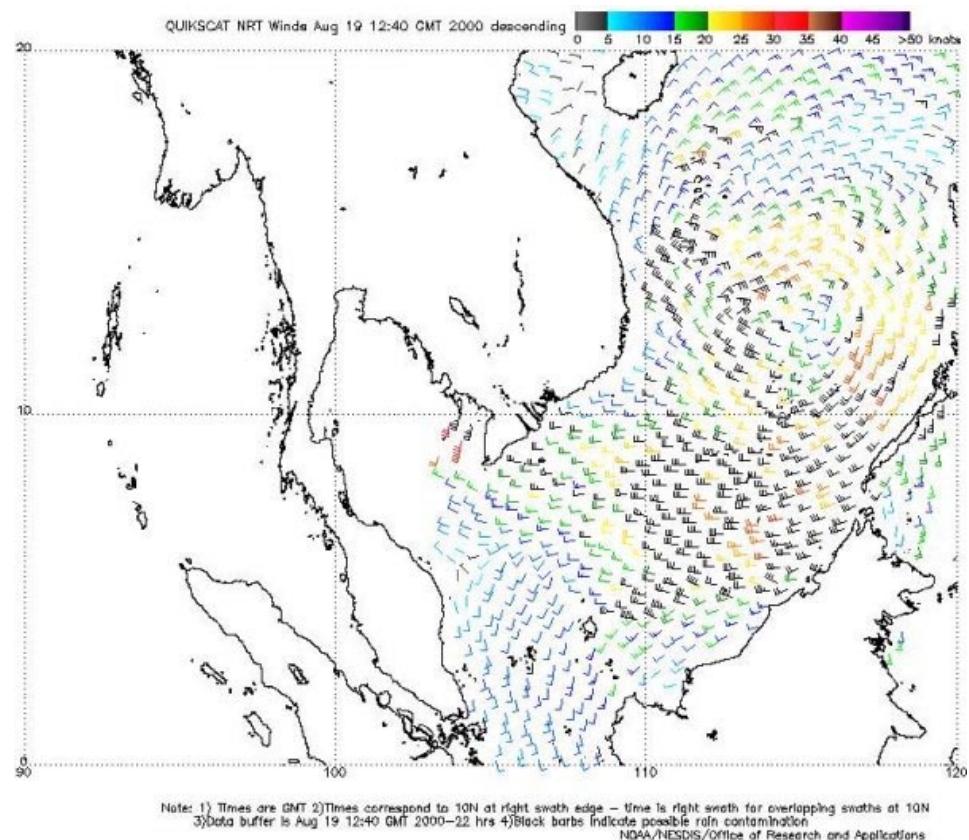


Figure 1-19W-1. 191240Z August 2000 QUIKSCAT image of TS 19W, located about 300 nm east of Cam Ranh Bay, Vietnam.

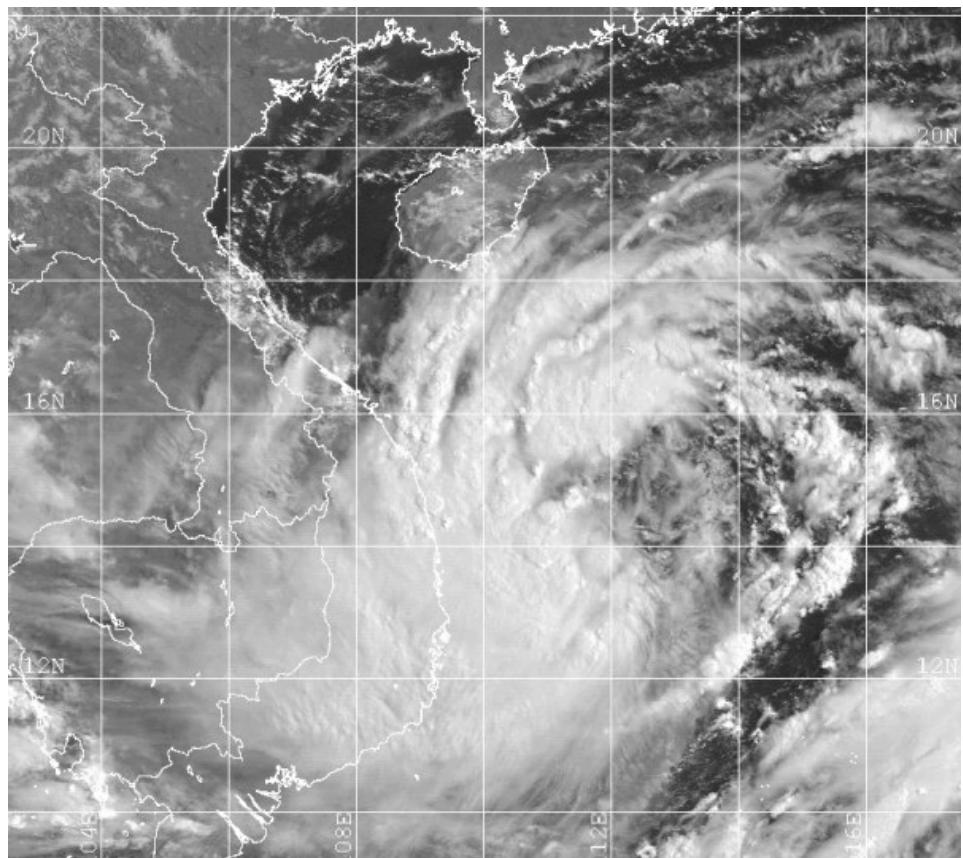


Figure 1-19W-2. 210031Z August 2000 GMS-5 visible image of TS 19W, with more organized deep convection evident around the low-level circulation center.

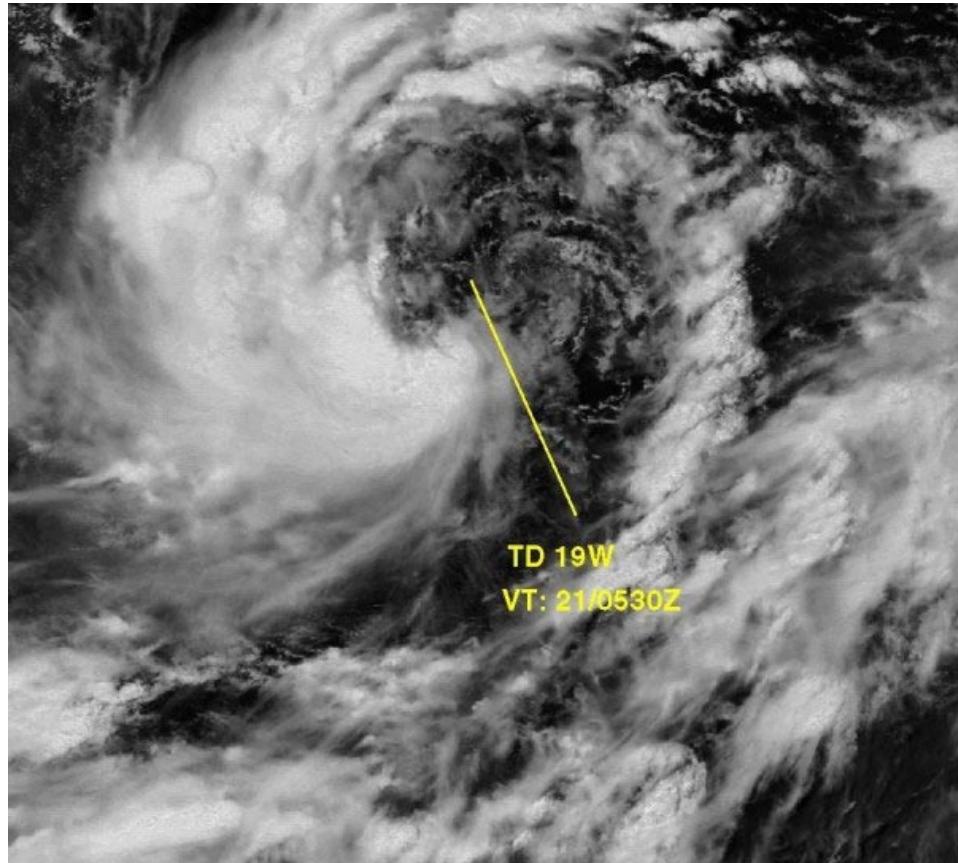
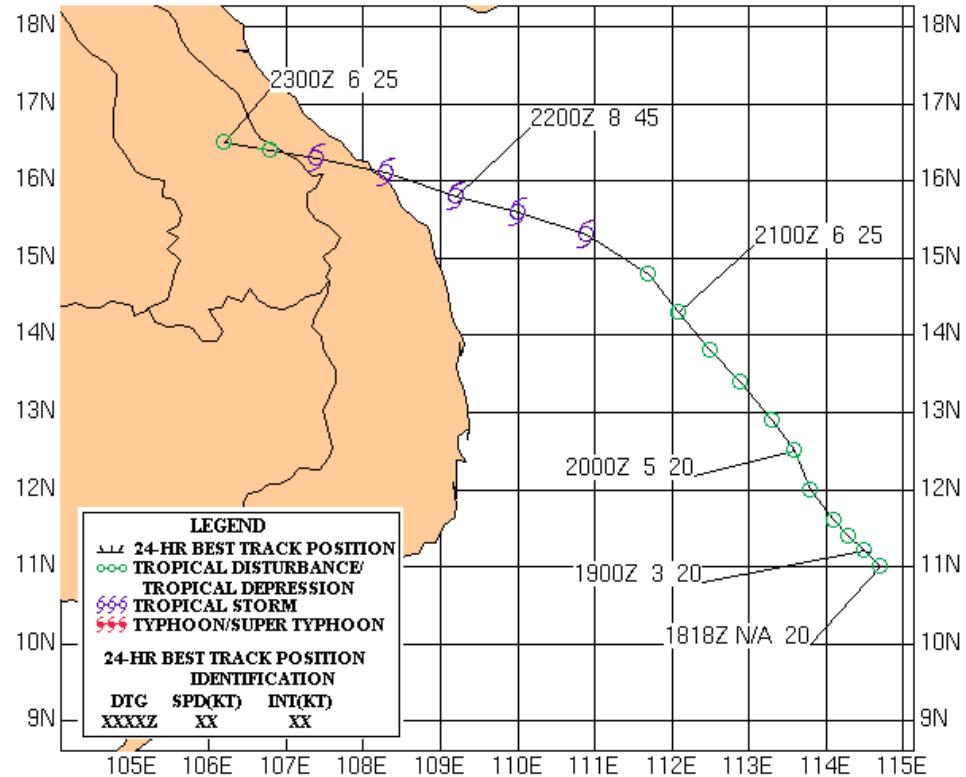


Figure 1-19W-3. 210530Z August 2000 GMS-5 visible image of TS 19W, located about 180 nm east-southeast of Da Nang, Vietnam. The fully exposed low-level circulation center is evident, with the deep convection displaced to the west and extending into a spiral rainband.

**TROPICAL STORM 19W (KAEMI)**  
**20 - 23 AUG 2000**



# **Typhoon (TY) 20W (Prapiroon\*)**

First Poor : 0600Z 22 Aug 00

First Fair : 0030Z 23 Aug 00

First TCFA : 2230Z 25 Aug 00

First Warning : 0000Z 26 Aug 00

Last Warning : 0600Z 01 Sep 00

Max Intensity : 75 kts, Gusts to 90 kts

Landfall : 1300Z 31 Aug 00 over North Korea

Total Warnings : 26

Remarks:

- (1) News reports indicated at least 10 fatalities in China (Xiangshui province and on Zhoushan Island) due to TY 20W. Reports further indicated that this cyclone caused the destruction of 7,500 homes and produced 210 mm of rain in Hsinchu, China.
- (2) The cyclone subsequently made landfall over North Korea with news reports indicating 46 people killed in collapsed structures, flooding, and landslides in the Republic of Korea. 29,400 houses were also reported destroyed and another 96,000 reported to have sustained flood damage. Rains associated with this cyclone washed away 470 km of paved roads in the Republic of Korea. Damages in the Republic of Korea were estimated at 12.5 billion Won (Korean money).
- (3) Wind gusts up to 130 mph were recorded on Huksan Island off the southwest coast of the Korean peninsula.

\* Name assigned by RSMC Tokyo

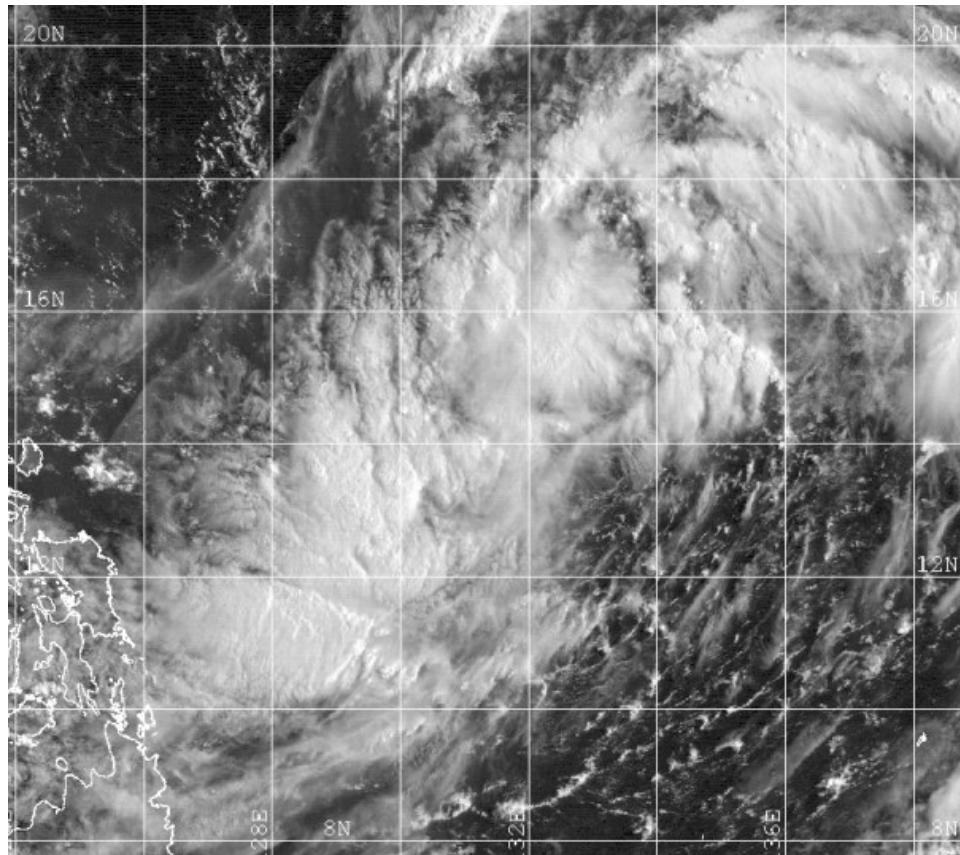


Figure 1-20W-1. 252301Z August 2000 GMS-5 visible image of the incipient disturbance that developed into TY 20W. At this time, the circulation center is located about 550 nm east of Luzon, Philippines.

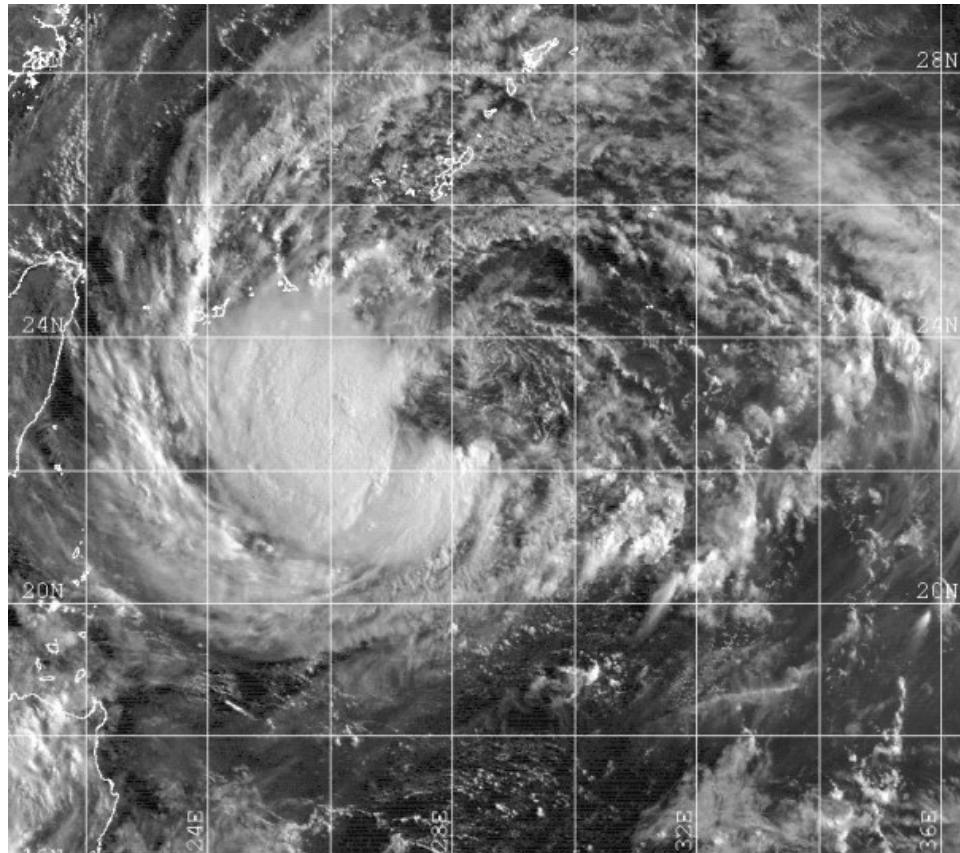


Figure 1-20W-2. 2722Z August 2000 GMS-5 visible image of TY 20W, located about 175 nm south of Okinawa at tropical storm (35 knot) intensity, with a large area of convection to the west.

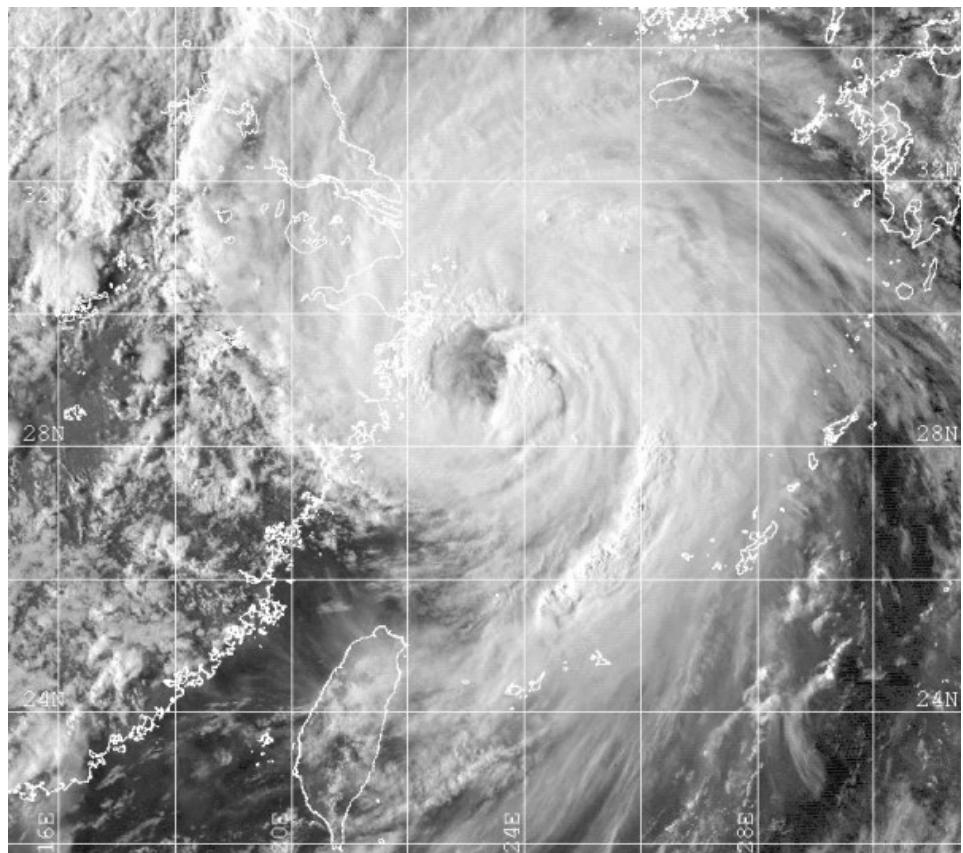


Figure 1-20W-3. 300831Z August 2000 GMS-5 visible image of TY 20W near maximum intensity (75 knots). The cyclone is located about 100 nm off the coast of southeast China and traveling north at 10 knots. A large eye and deep convection in most quadrants are evident, with a rainband located 250 nm to the southeast of the circulation center.

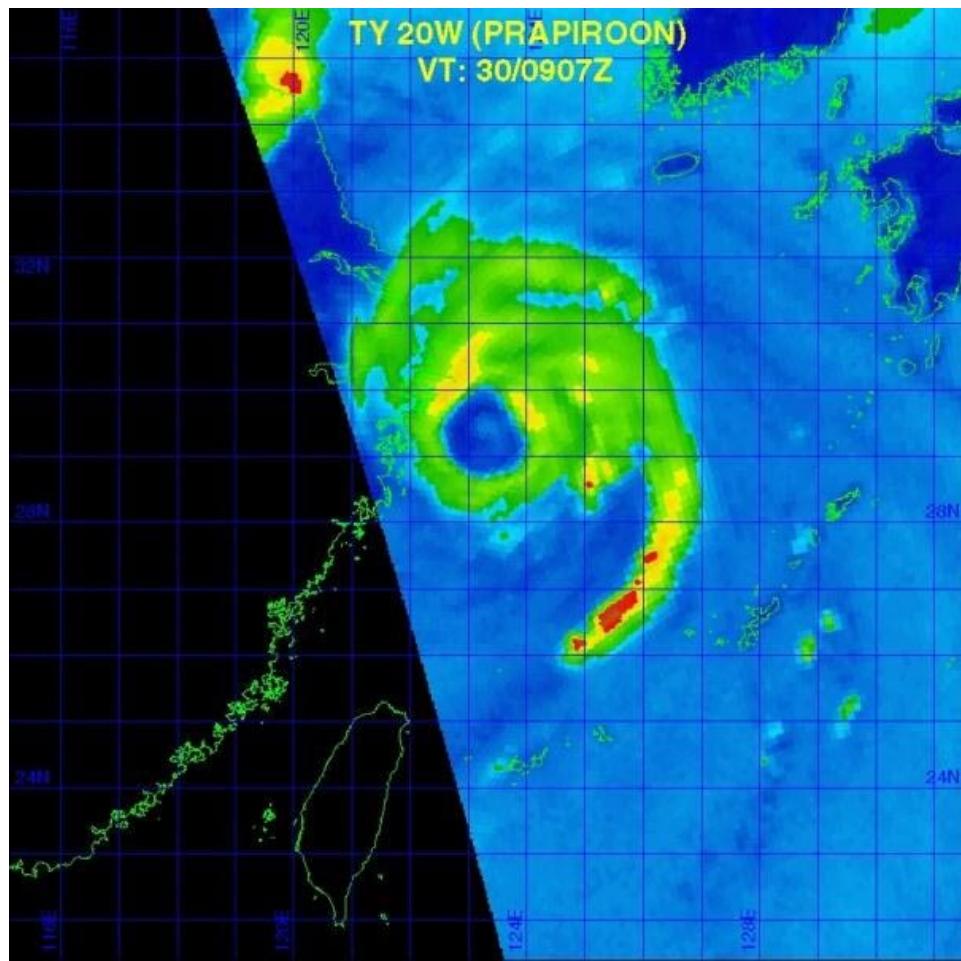
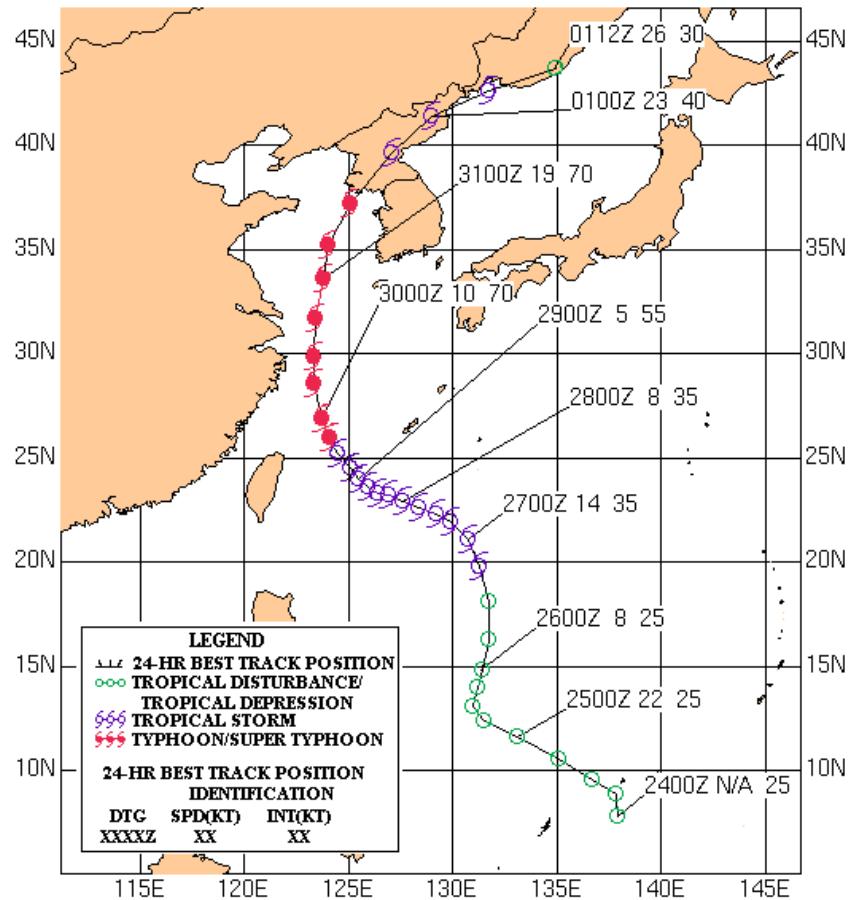


Figure 1-20W-4. 300907Z August 2000 SSMI 85 GHz image of TY 20W, which clearly shows the large eye and the vigorous rainband to the southeast.

**TYPHOON 20W (PRAPIROON)**  
**26 AUG - 01 SEP 2000**



## **Tropical Storm (TS) 21W (Maria\*)**

First Poor : 2200Z 26 Aug 00

First Fair : 1200Z 27 Aug 00

First TCFA : 1730Z 27 Aug 00

First Warning : 0000Z 28 Aug 00

Last Warning : 0600Z 01 Sep 00

Max Intensity : 55 kts, Gusts to 70 kts

Landfall : 2000Z 31 Aug 00 east of Hong Kong

Total Warnings : 18

Remarks:

- (1) TS 21W formed and remained in the northeast South China Sea, moving in a very tight U-shaped track for approximately 100 hours before moving inland between Huidong and Haifeng, Guangdong province, China.
- (2) The China Meteorological Administration reported that TS 21W caused 72 fatalities, wounded 772 persons, and caused economic losses estimated at \$317 million.

\* Name assigned by RSMC Tokyo

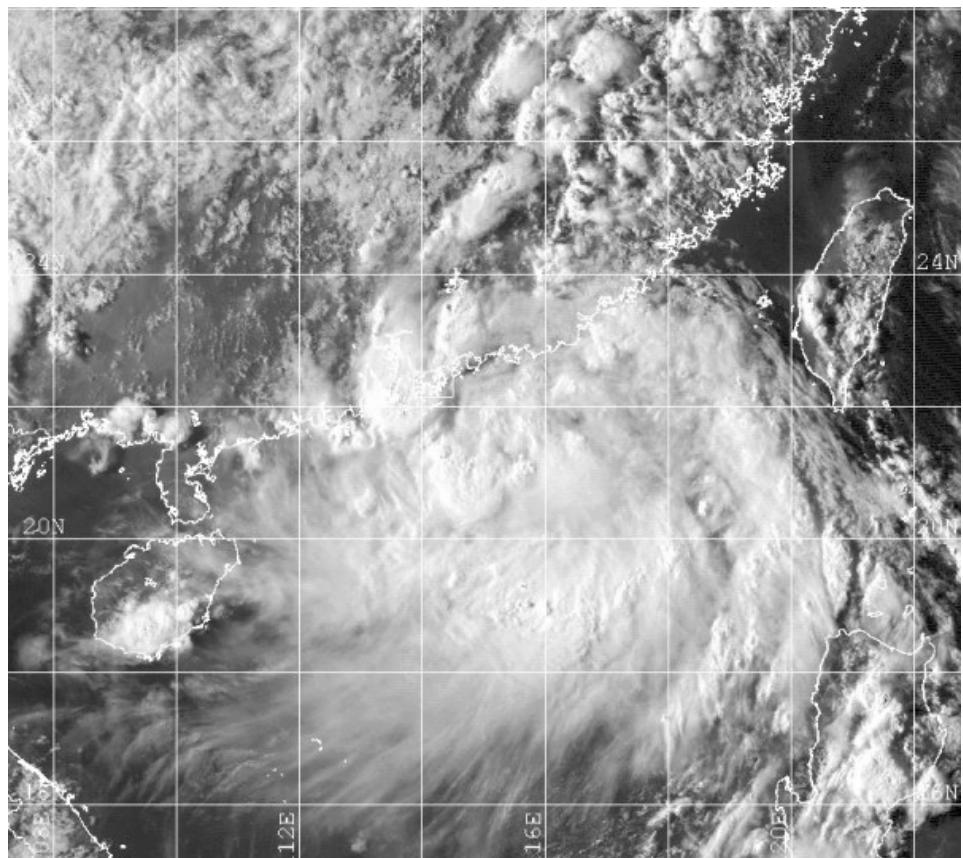


Figure 1-21W-1. 270831Z August 2000 GMS-5 visible image of the broad area of convection south of China which developed into TS 21W.

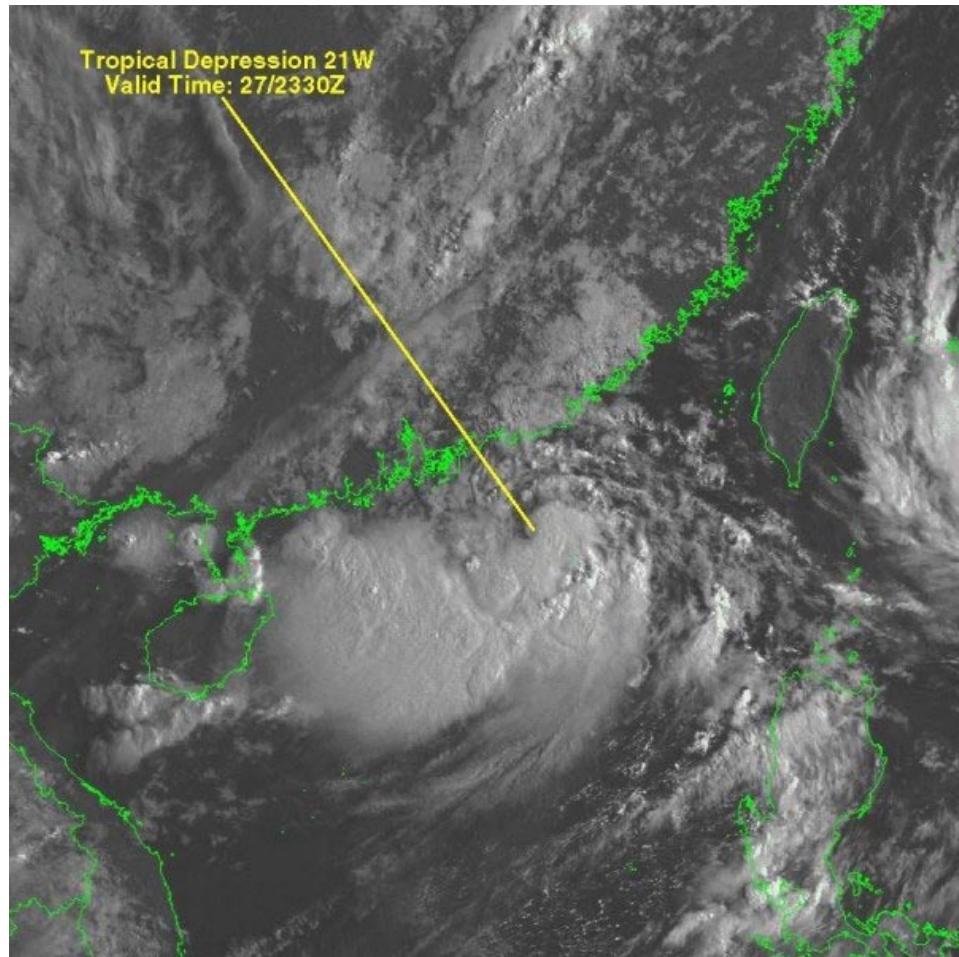


Figure 1-21W-2. 272330Z August 2000 GMS-5 visible image of TS 21W, with the low-level circulation center located about 100 nm east-southeast of Hong Kong, China. Deep convection is seen wrapping around the circulation center, as a large rainband stretches to the west.

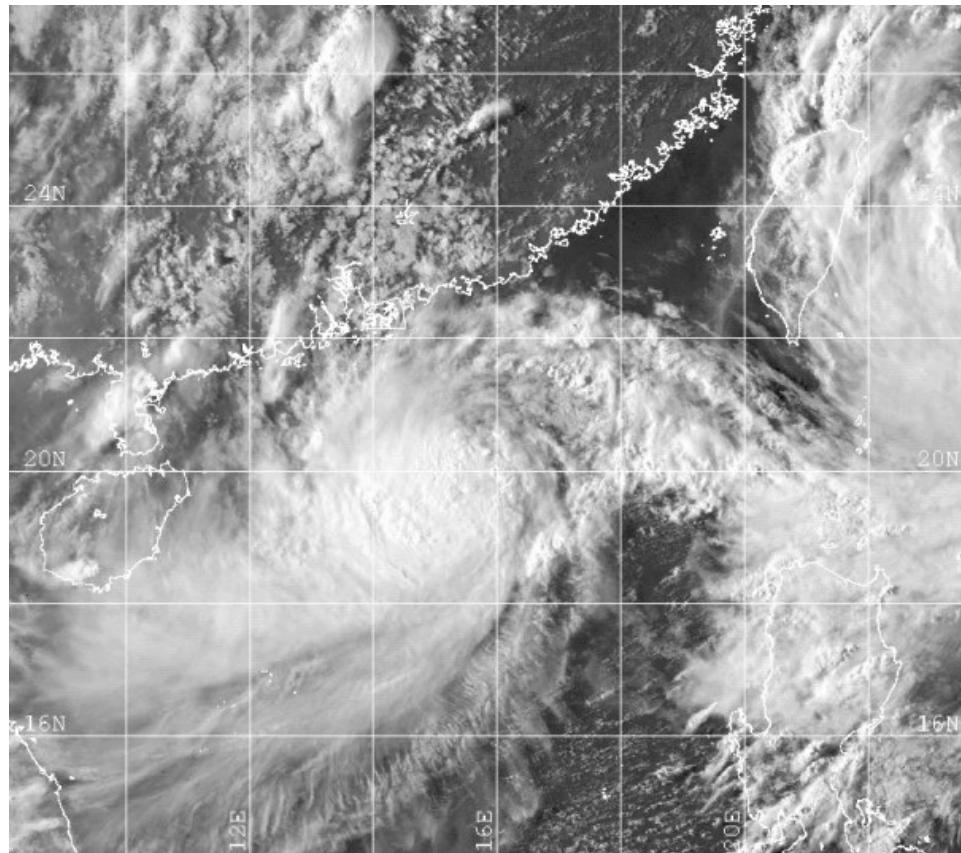


Figure 1-21W-3. 280831Z August 2000 GMS-5 visible image of TS 21W, located about 120 nm east-southeast of Hong Kong with deep convection mainly to the southwest. The banding feature that extends into Luzon Strait appears to suggest linkage or association with TY 20W, which at this time, is located east of Taiwan.

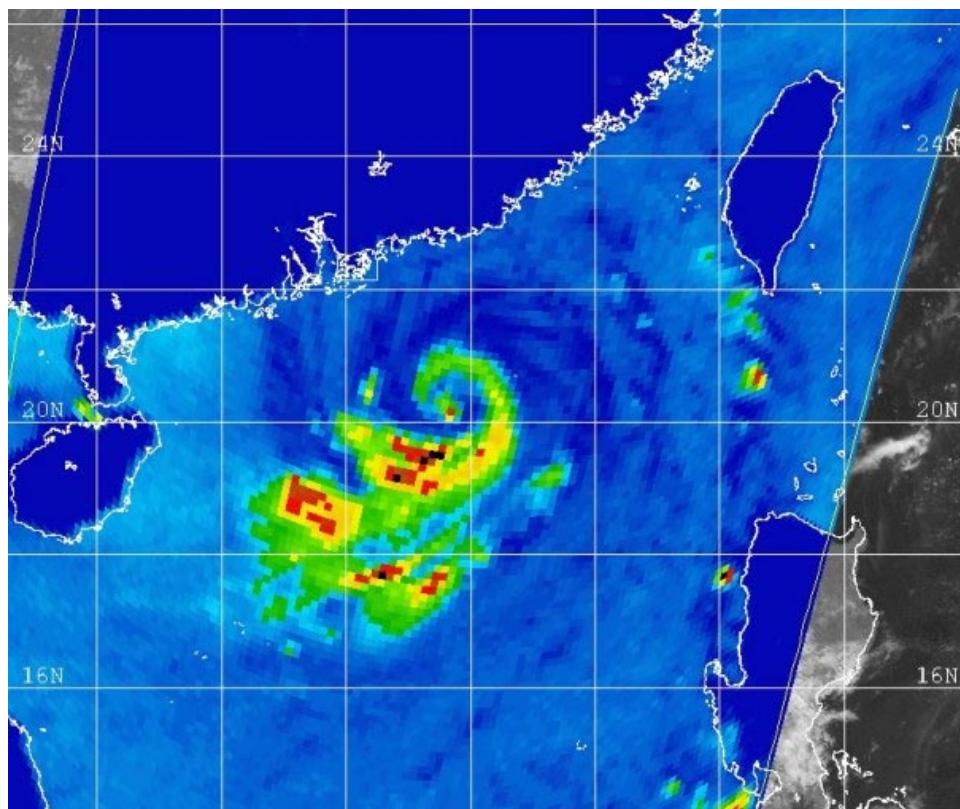


Figure 1-21W-4. 310131Z August 2000 SSMI 85 GHz image of TS 21W, depicting spiral banding around the center. At this time, the cyclone is about 170 nm east-southeast of Hong Kong, moving north at 7 knots.

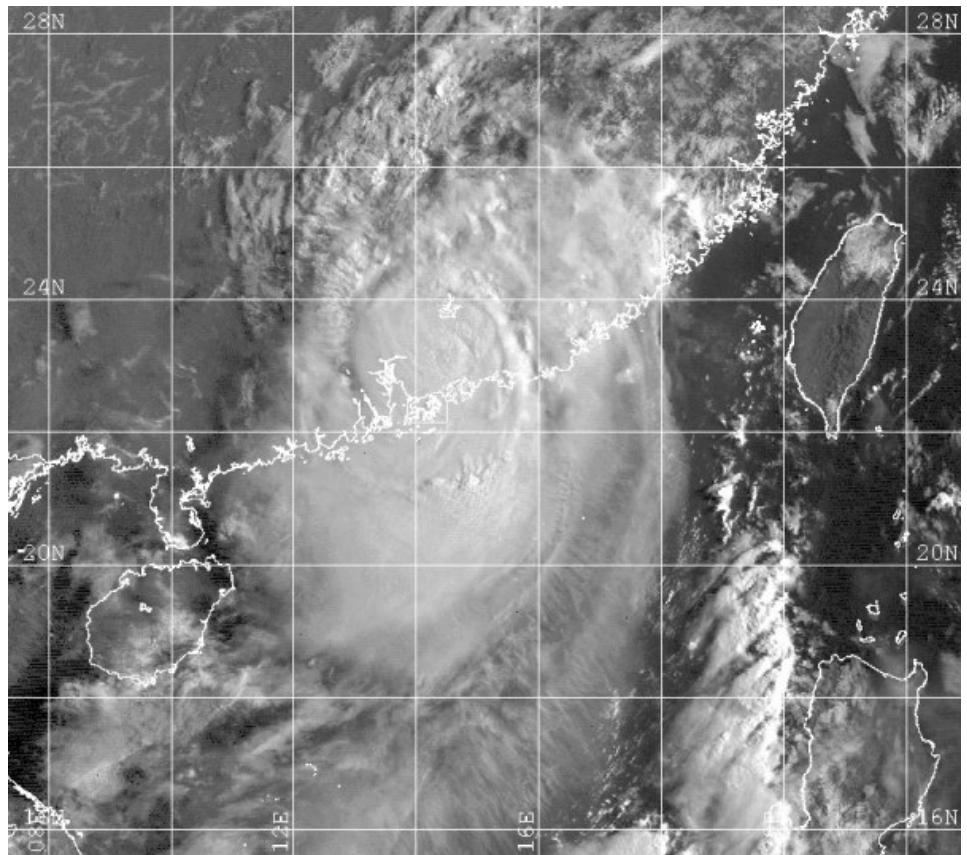
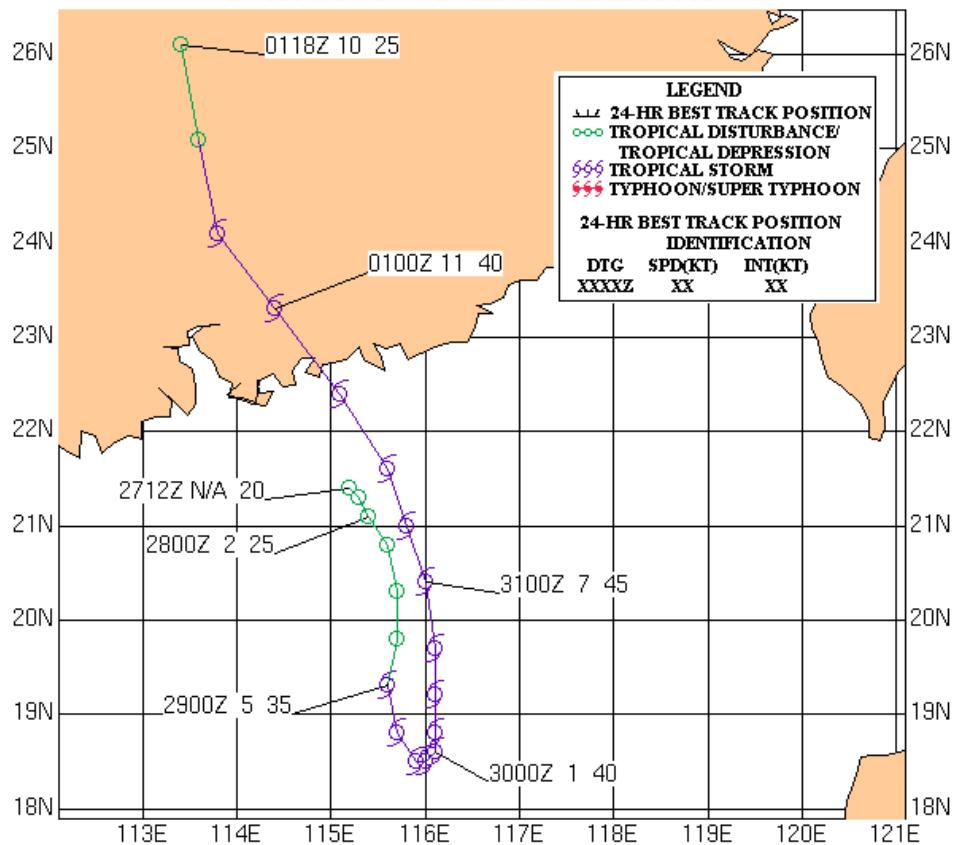


Figure 1-21W-5. 312301Z August 2000 GMS-5 visible image of TS 21W, just after landfall over China, with maximum sustained winds of 55 knots and deep convection still present near the center.

**TROPICAL STORM 21W (MARIA)**  
**27 AUGUST - 01 SEPTEMBER 2000**



# **Super Typhoon (STY) 22W (Saomai\*)**

First Poor : 0600Z 31 Aug 00

First Fair : 0600Z 01 Sep 00

First TCFA : 0130Z 02 Sep 00

First Warning : 1200Z 02 Sep 00

Last Warning : 0600Z 16 Sep 00

Max Intensity : 140 kts, Gusts to 170 kts

Landfall : 2030Z 15 Sep 00

Total Warnings : 56

Remarks:

- (1) STY 22W was a long-lived cyclone that affected Japan and South Korea after passing through the Mariana Islands.
- (2) Rapid intensification occurred between 0600Z on 9 September (90 kts) and 1800Z on 10 September (140 kts): 50 kts in 30 hours.
- (3) Kadena Air Base, Okinawa, recorded more than six inches of rain, with maximum sustained winds of 51 knots and gusts to 76 knots. One U.S. serviceman on Okinawa drowned during storm passage. Yoron Island, north of Okinawa, reported sustained winds of 65 knots.
- (4) The outer edges of STY 22W also affected Zhoushan Island, China, destroying more than 700 homes.
- (5) STY 22W produced over 32 inches of rain in parts of central Japan, killing 7 people, while flooding 12,000 homes and destroying 14.
- (6) The Korea Meteorological Administration (KMA) reported that STY 22W produced 491 mm of heavy rainfall during 12 to 16 September in the southern portion of the Republic of Korea. KMA also reported 6 fatalities, with 990 injured and an estimated 7000 ha of farmland flooded due to this cyclone.

\* Name assigned by RSMC Tokyo

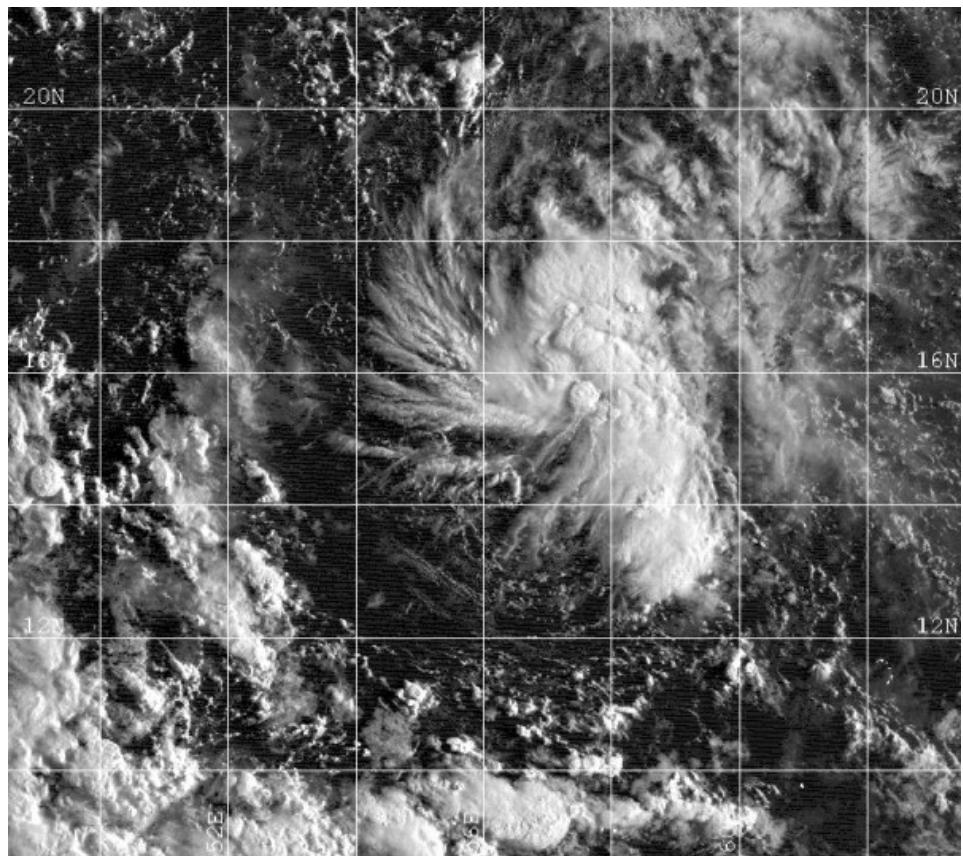


Figure 1-22W-1. 012031Z September 2000 GMS-5 visible image of the disturbance (located about 12 degrees east of the Mariana Islands) that developed into STY 22W.

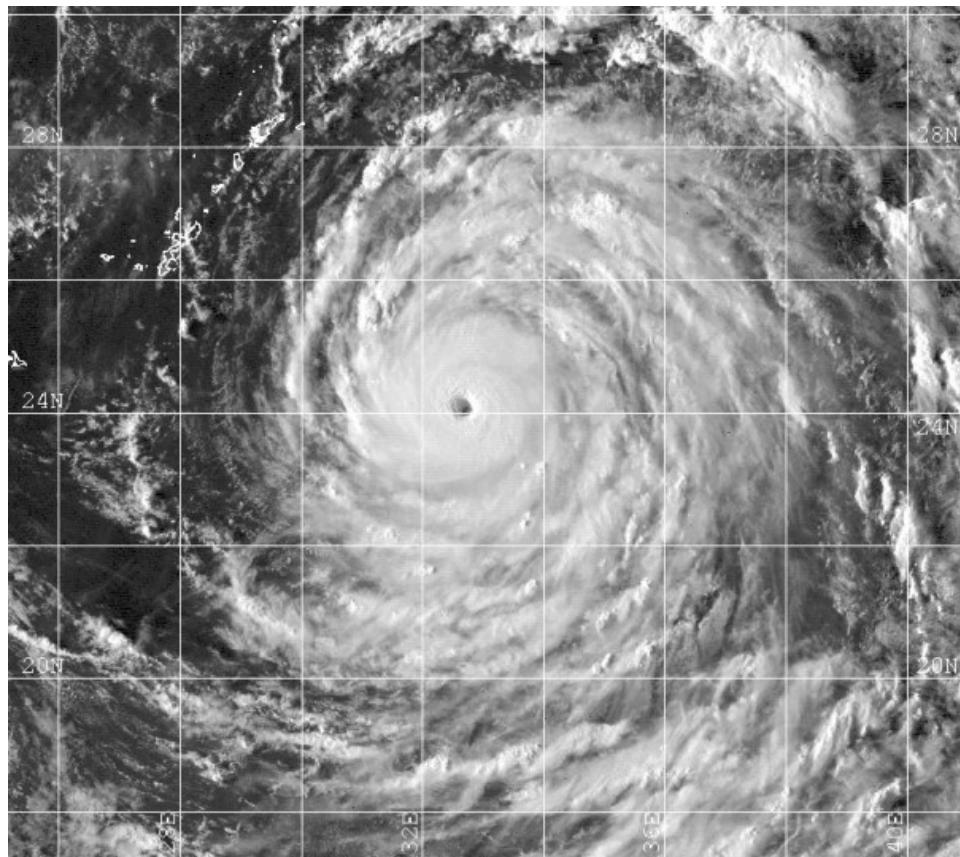


Figure 1-22W-2. 100731Z September 2000 GMS-5 visible image of STY 22W, with a well-defined eye embedded in a symmetric central dense overcast. Outflow can be seen in all directions. At this time, the cyclone is located about 310 nm east-southeast of Okinawa, Japan.

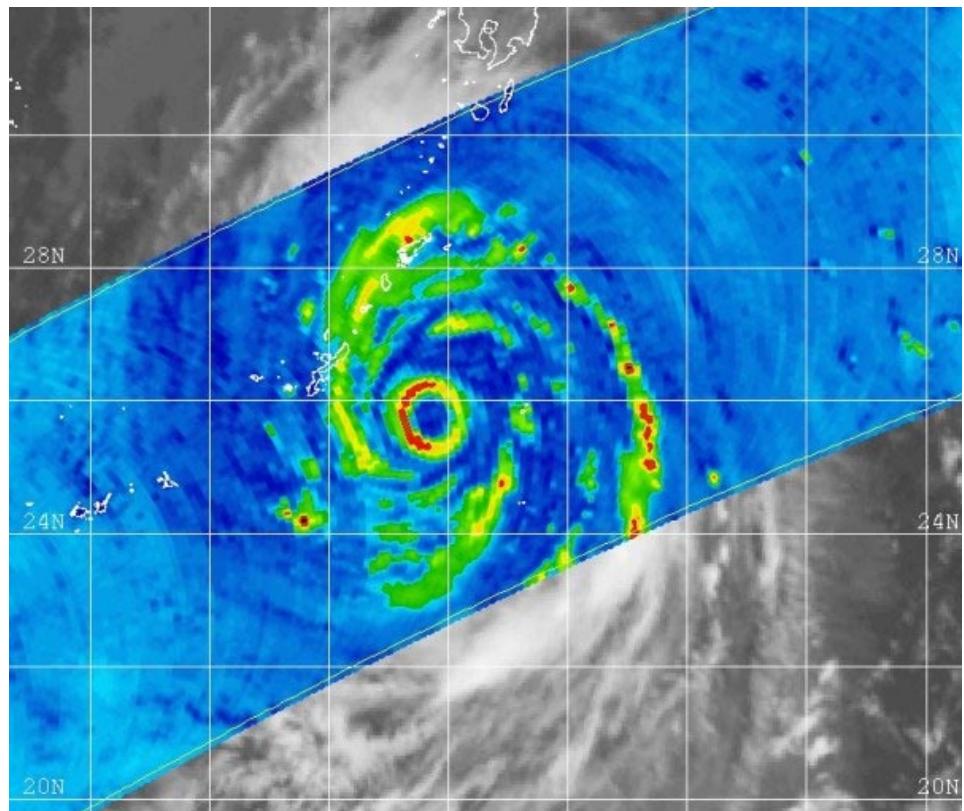


Figure 1-22W-3. 111541Z September 2000 TRMM 85 GHz image of STY 22W, when the cyclone was located about 125 nm east-southeast of Okinawa and less than 24 hours before passing over that island. An intense eyewall is seen, along with several bands around the periphery of the circulation center.

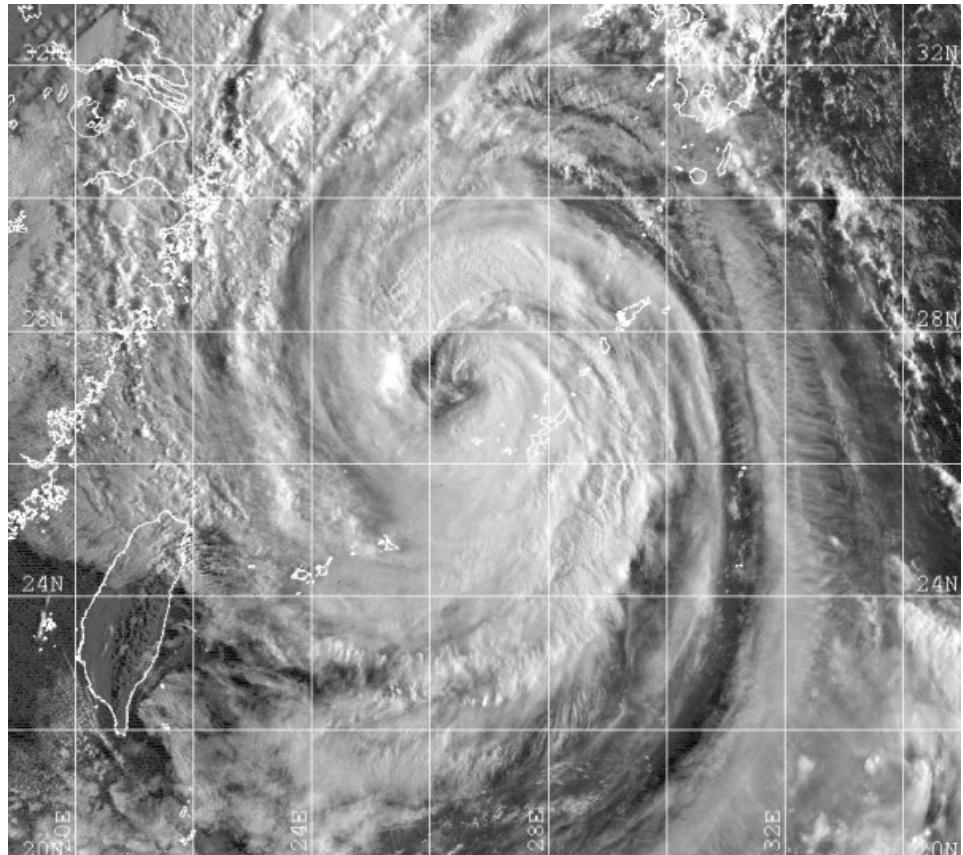


Figure 1-22W-4. 1222Z September 2000 GMS-5 visible image of STY 22W, when the cyclone was located about 75 nm northwest of Okinawa with a filling eye and most of the deep convection only in the eastern semicircle.

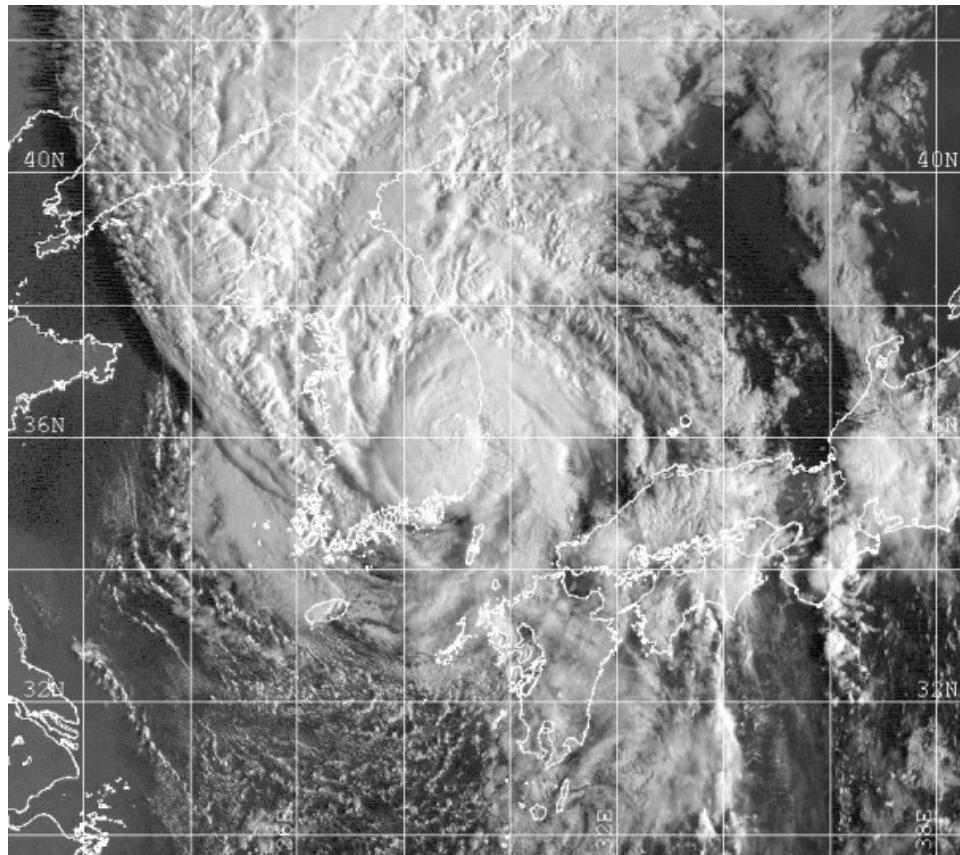
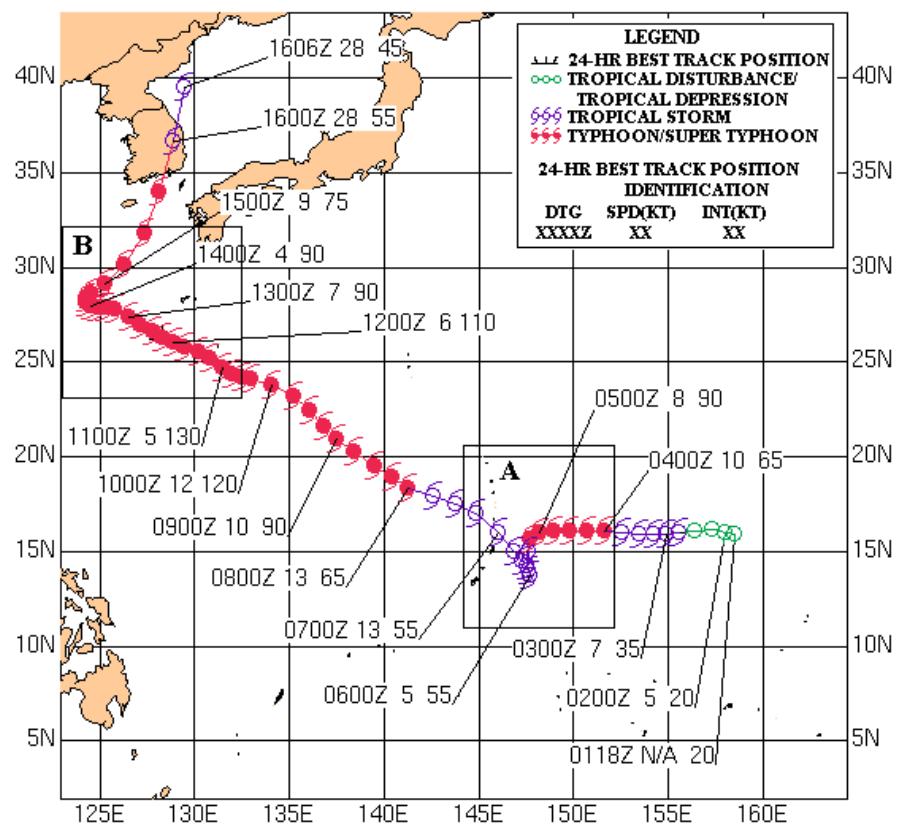
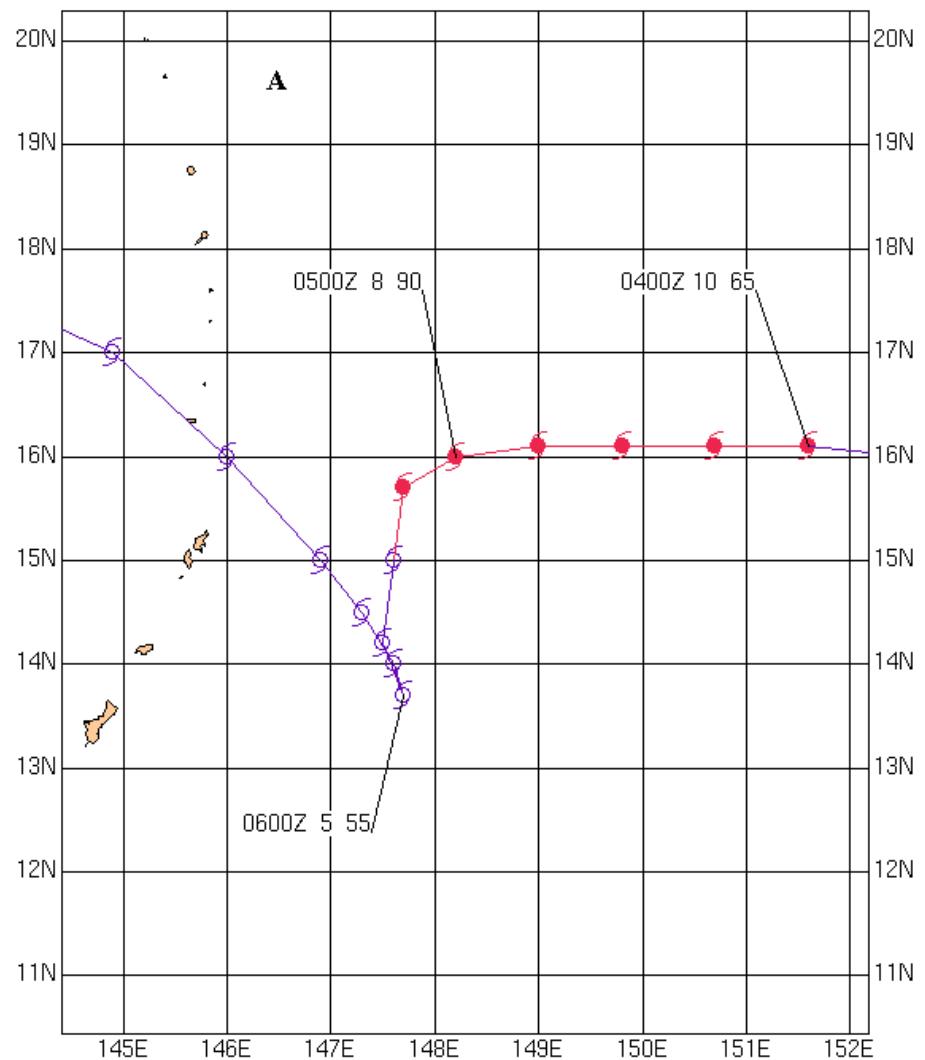


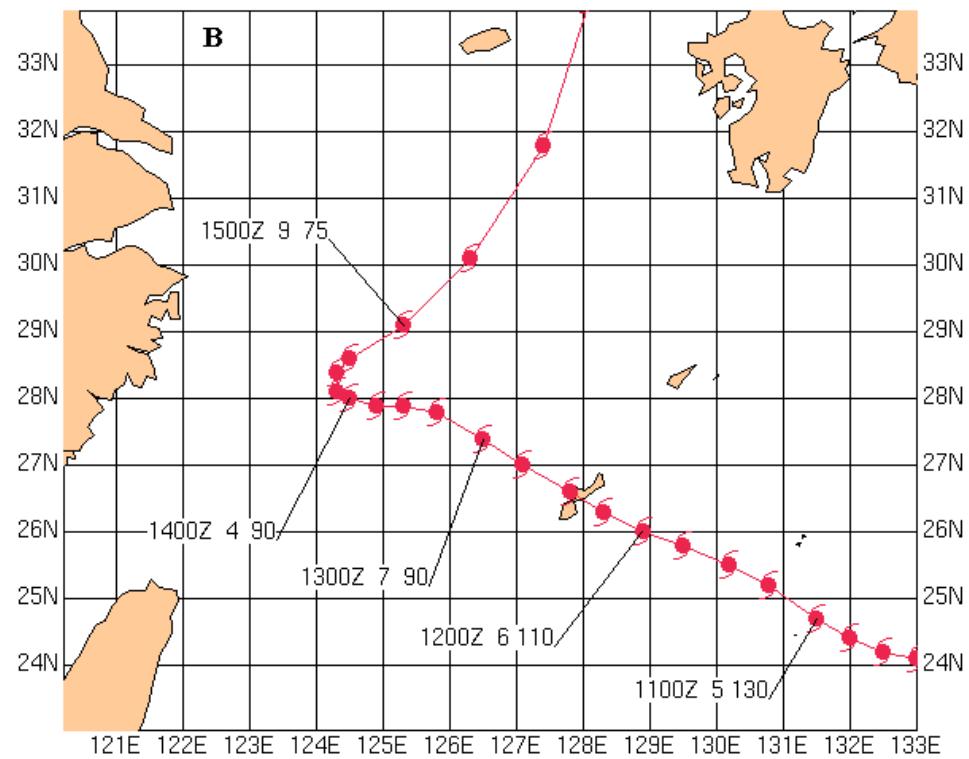
Figure 1-22W-5. 1522Z September 2000 GMS-5 visible image of STY 22W, just a few hours after landfall over South Korea. The cyclone had begun extra-tropical transition, with convection displaced to the north.

**SUPER TYPHOON 22W (SAOMAI)**  
**02 - 16 SEPTEMBER 2000**



See below to view insets "A" and "B" detail





## **Typhoon (TY) 23W (Wukong\*)**

First Poor : None

First Fair : 0600Z 04 Sep 00

First TCFA : 0300Z 05 Sep 00

First Warning : 0600Z 05 Sep 00

Last Warning : 0600Z 10 Sep 00

Max Intensity : 95 kts, Gusts to 115 kts

Landfall : 0500Z 10 Sep 00

Total Warnings : 21

Remarks:

- (1) Five fatalities with 2700 homes destroyed were reported in Hainan province, China.
- (2) TY 23W reportedly caused two fatalities and destroyed 3,000 destroyed homes in Ha Tinh, Vietnam.
- (3) Heavy rainfall recorded in Ha Tinh and surrounding districts.

\* Name assigned by RSMC Tokyo

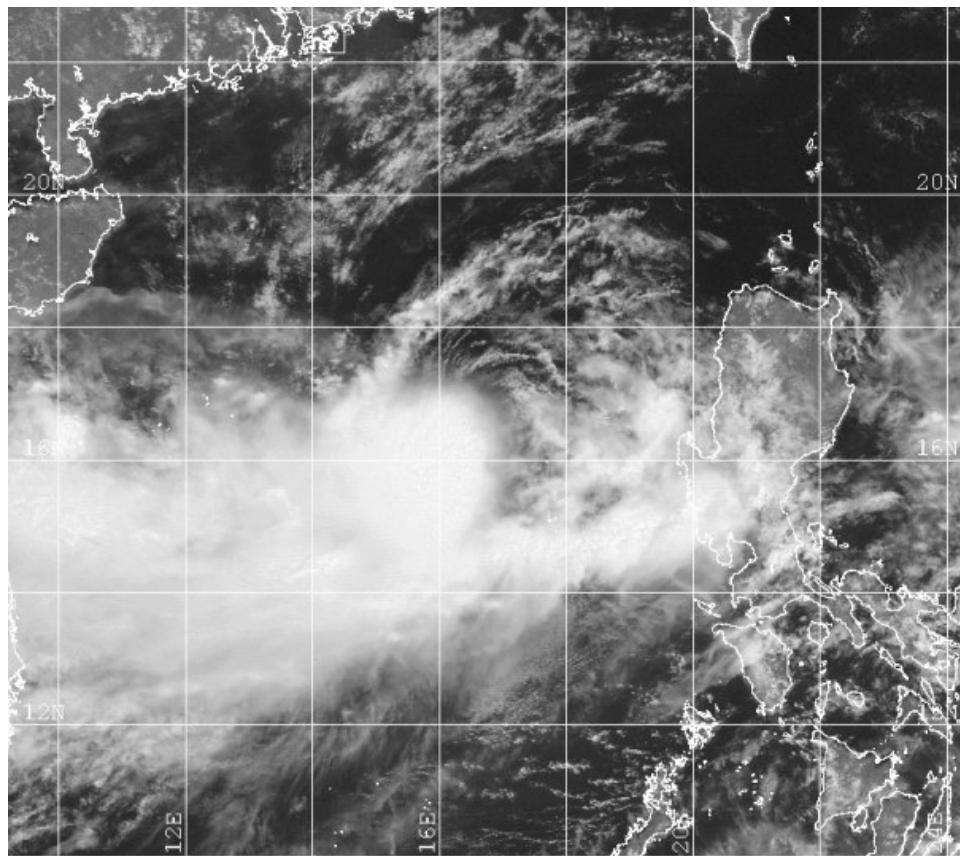


Figure 1-23W-1. 050331Z September 2000 GMS-5 visible image of TY 23W as a developing tropical cyclone of less than 25 knots maximum intensity. The low-level circulation center is evident and located on the northeast periphery of the heavy convection. The cyclone is located about 280 nm west-northwest of Manila at this time.

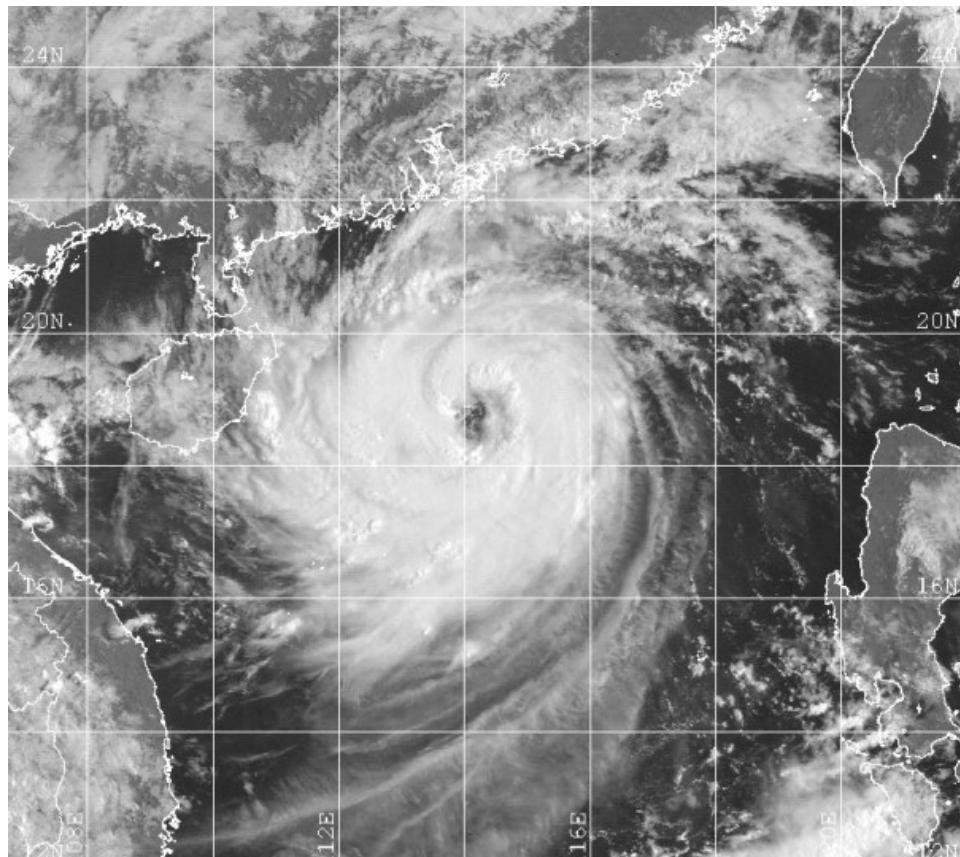


Figure 1-23W-2. 080031Z September 2000 GMS-5 visible image of TY 23W when the cyclone was located about 210 nm east of Hainan Island and tracking westward. Good outflow is seen in all quadrants as well as a clear but irregular eye.

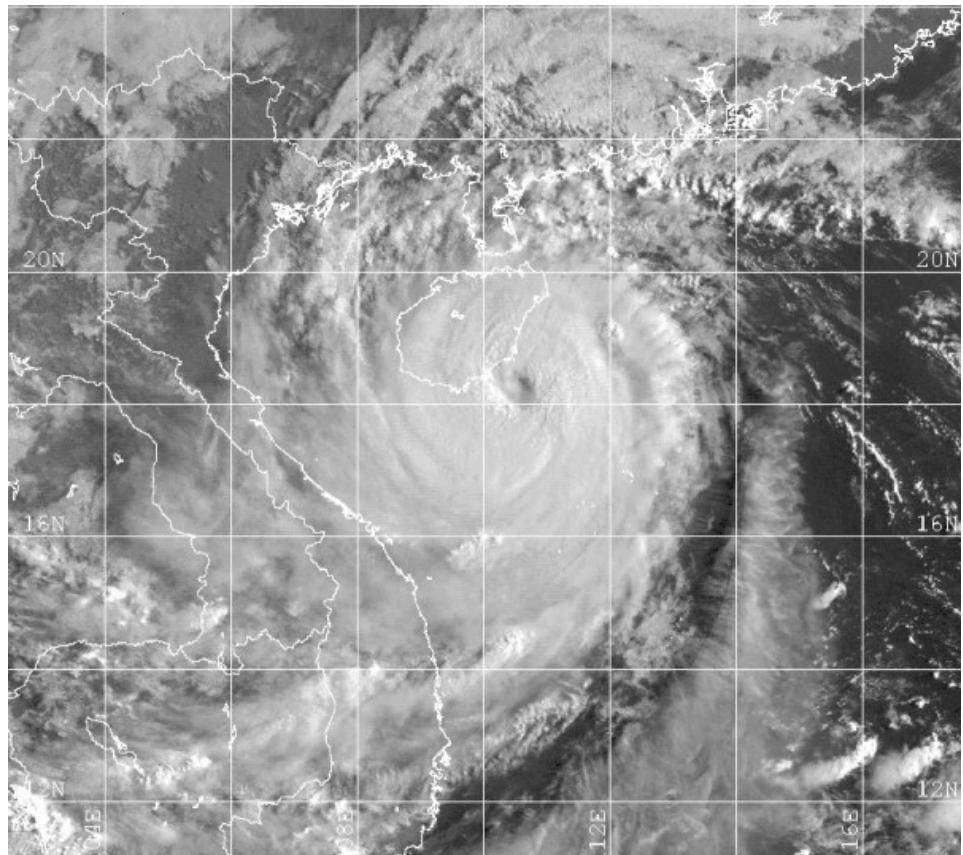
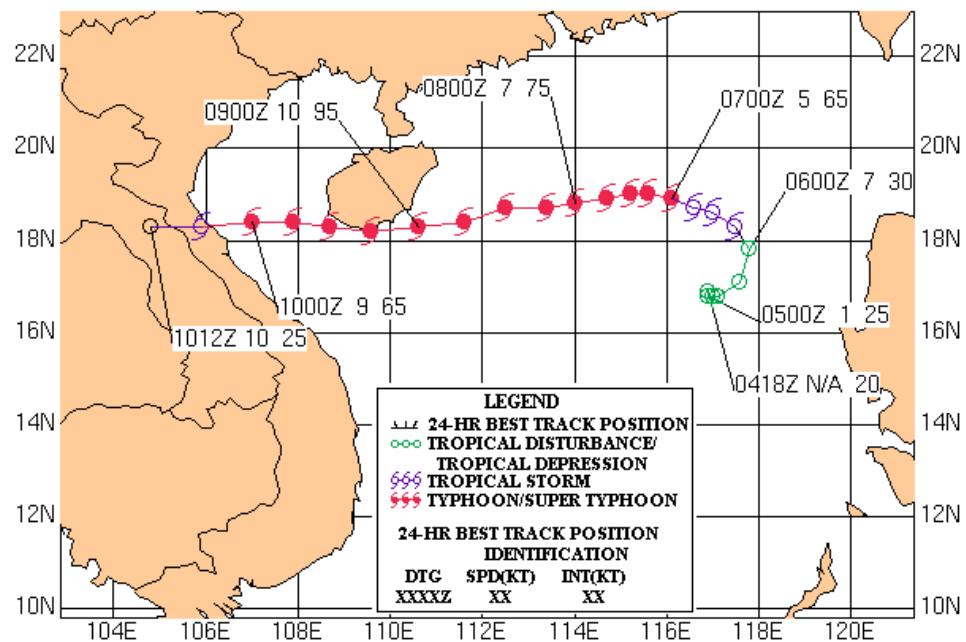


Figure 1-23W-3. 082331Z September 2000 GMS-5 visible image of TY 23W as it began to move along the coast of Hainan Island. A well-defined central dense overcast can be seen surrounding a partially obscured eye.

**TYPHOON 23W (WUKONG)**  
**05 - 10 SEPTEMBER 2000**



## **Tropical Storm (TS) 24W (Bopha\*)**

First Poor : 0830Z 04 Sep 00

First Fair : 0600Z 05 Sep 00

First TCFA : 1600Z 05 Sep 00

First Warning : 1800Z 05 Sep 00

Last Warning : 0000Z 12 Sep 00

Max Intensity : 55 kts, Gusts to 70 kts

Landfall : 0000Z 11 Sep 00 over Northern Luzon

Total Warnings : 26

Remarks:

- (1) Rough seas generated by TS 24W capsized a ferry in the waters south of Manila, killing four people.
- (2) The unusual southward track was caused by interaction with STY 22W.

\* Name assigned by RSMC Tokyo

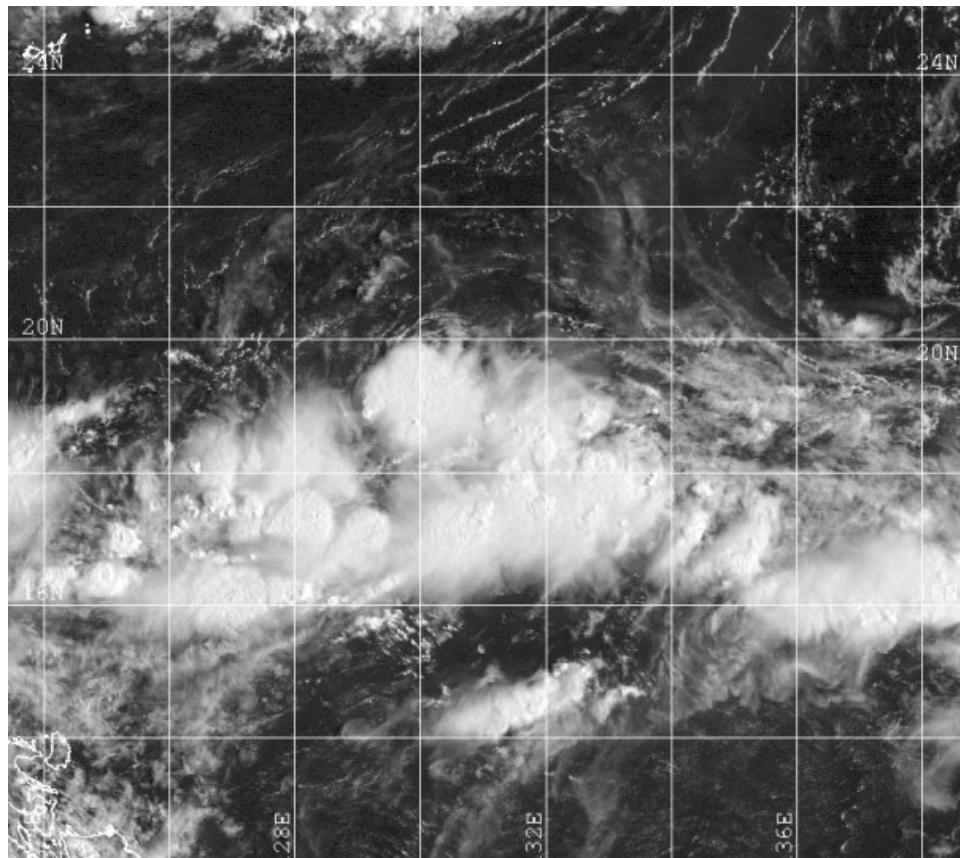


Figure 1-24W-1. 042331Z September 2000 GMS-5 visible image of the tropical disturbance that developed into TS 24W.

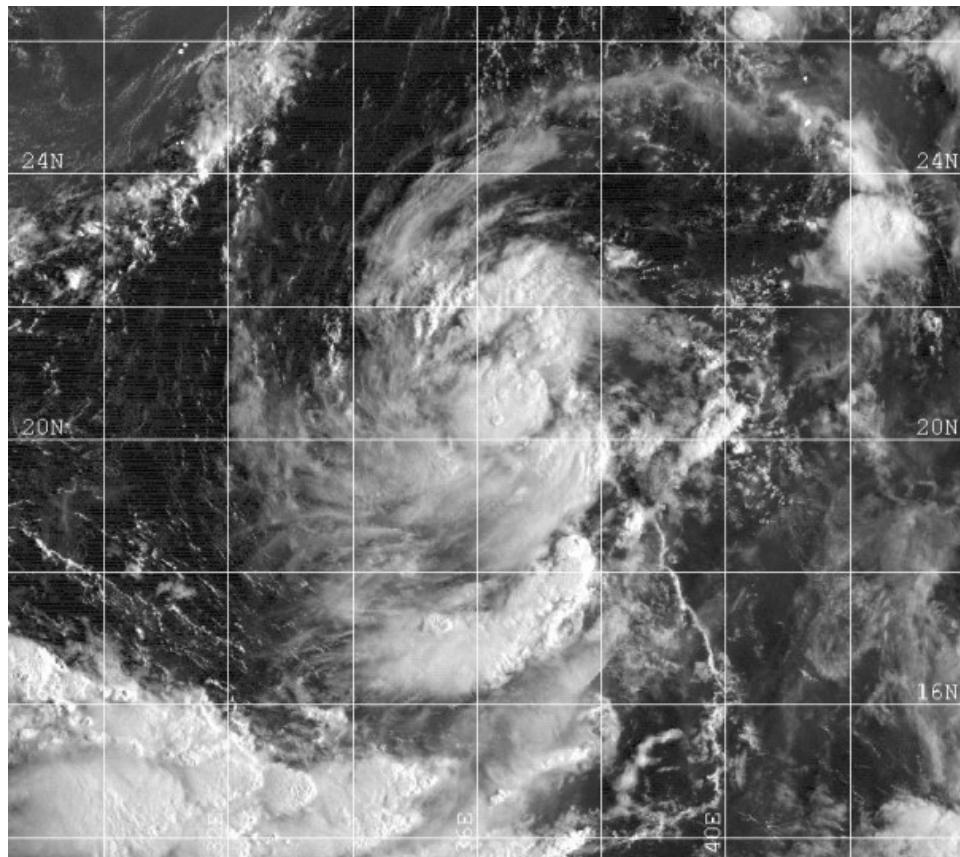


Figure 1-24W-2. 0522Z September 2000 GMS-5 visible image of TS 24W, with convection organized around the central dense overcast and a large convective band evident to the south of the circulation center. At this time, the cyclone is located 570 nm east-southeast of Okinawa.

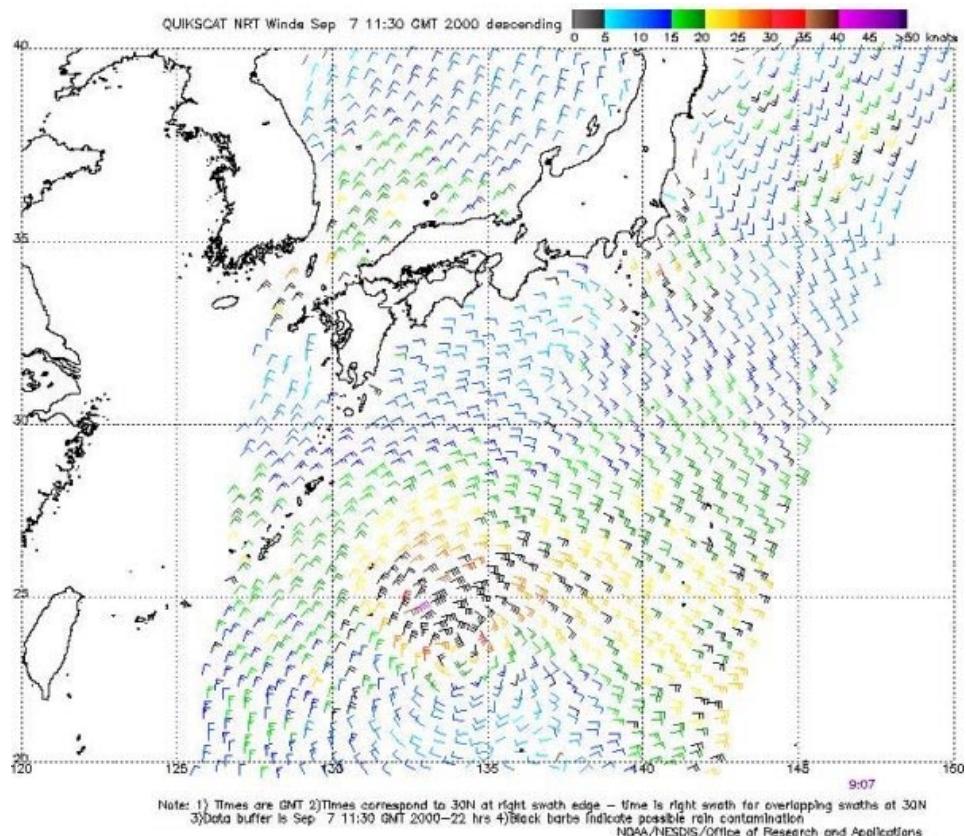


Figure 1-24W-3. 071130Z September 2000 QUIKSCAT image of TS 24W, located 400 nm east-southeast of Okinawa.

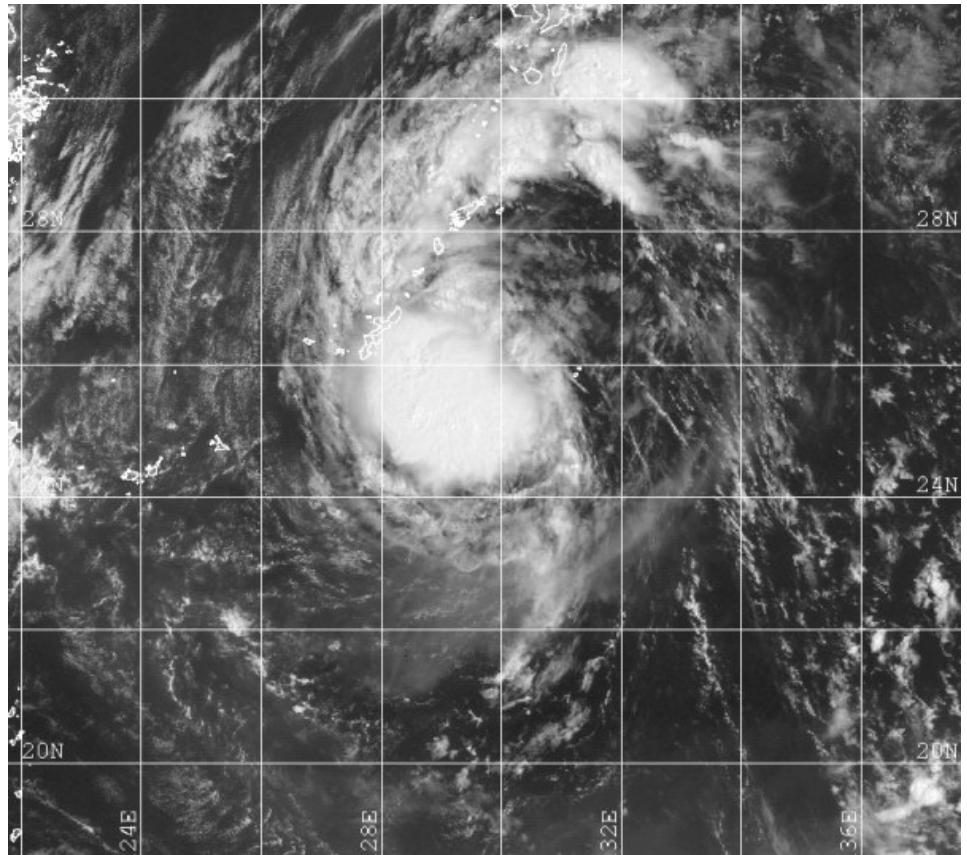


Figure 1-24W-4. 0800Z September 2000 GMS-5 visible image of TS 24W, located about 140 nm east-southeast of Okinawa.

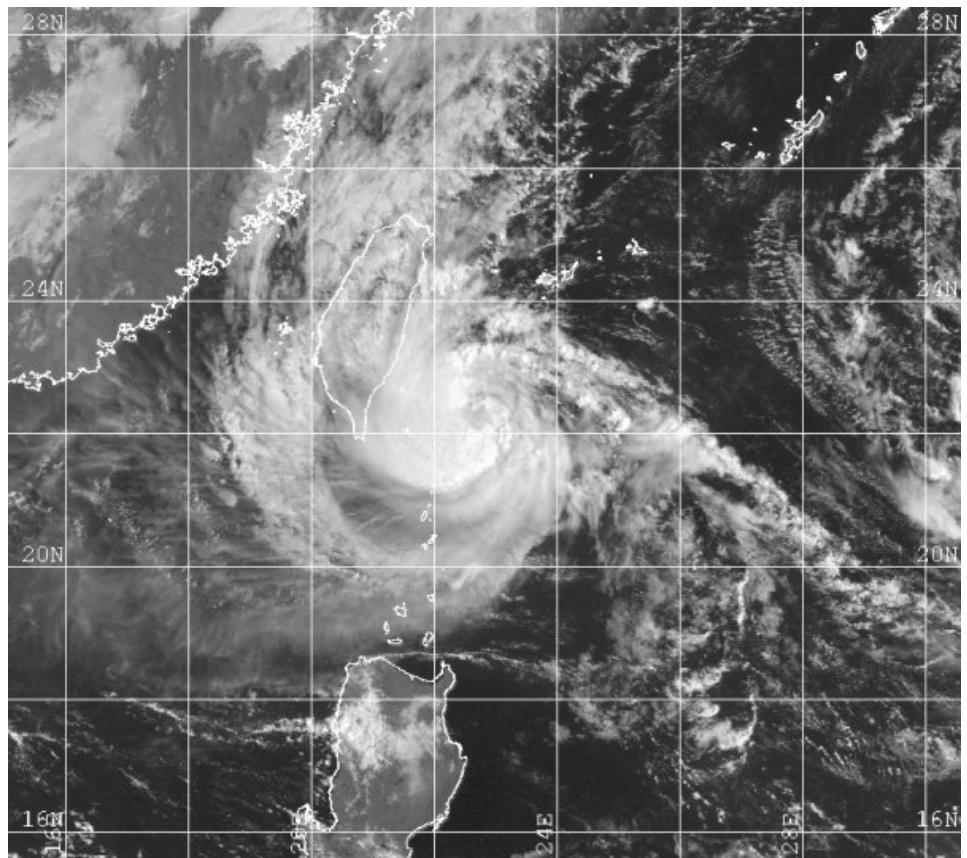
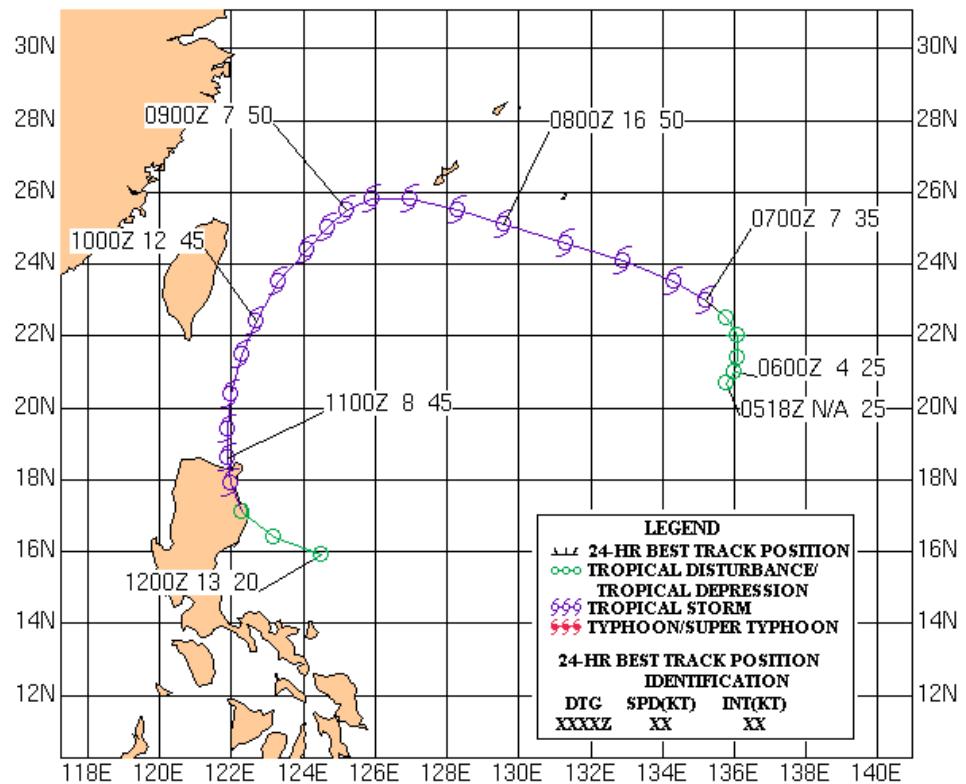


Figure 1-24W-5. 100031Z September 2000 GMS-5 visible image of TS 24W, located just off the southeast coast of Taiwan.

**TROPICAL STORM 24W (BOPHA)**  
**05 - 12 SEPTEMBER 2000**



## Typhoon (TY) 25W (Sonamu\*)

First Poor : None

First Fair : None

First TCFA : 0430Z 14 Sep 00

First Warning : 0600Z 14 Sep 00

Last Warning : 0000Z 18 Sep 00

Max Intensity : 75 kts, Gusts to 90 kts

Landfall : None

Total Warnings : 16

Remarks : None

\* Name assigned by RSMC Tokyo

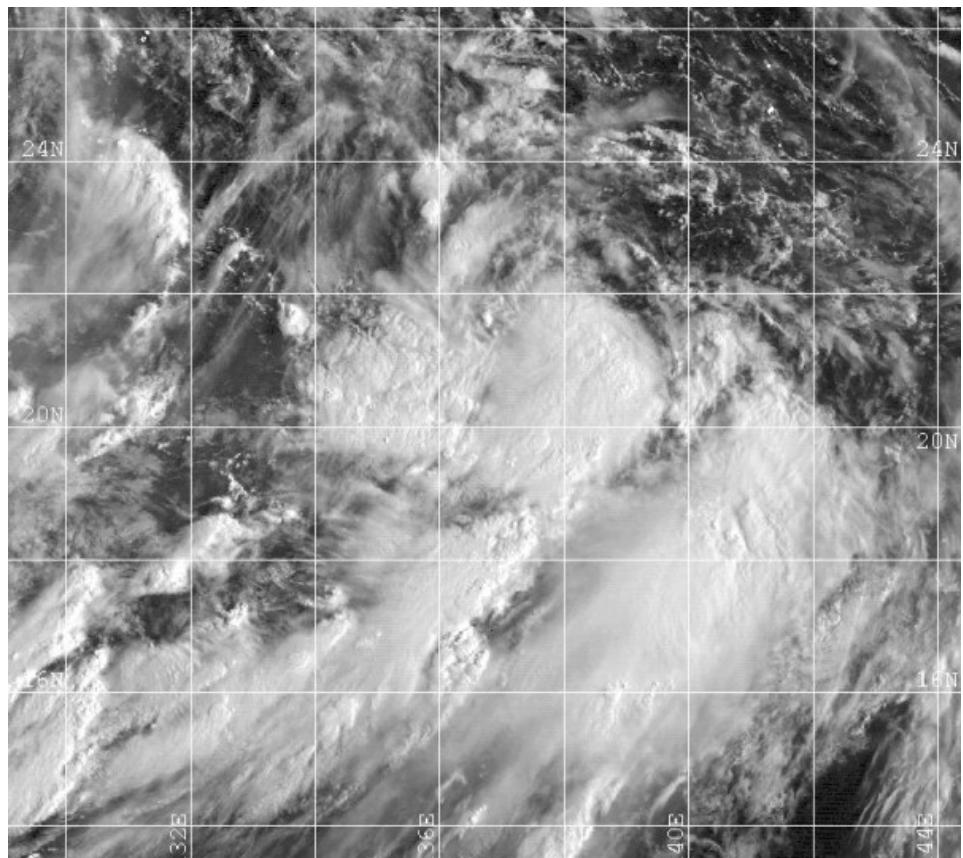


Figure 1-25W-1. 1322Z September 2000 GMS-5 visible image of the broad region of convection southwest of Iwo Jima which developed into TY 25W.

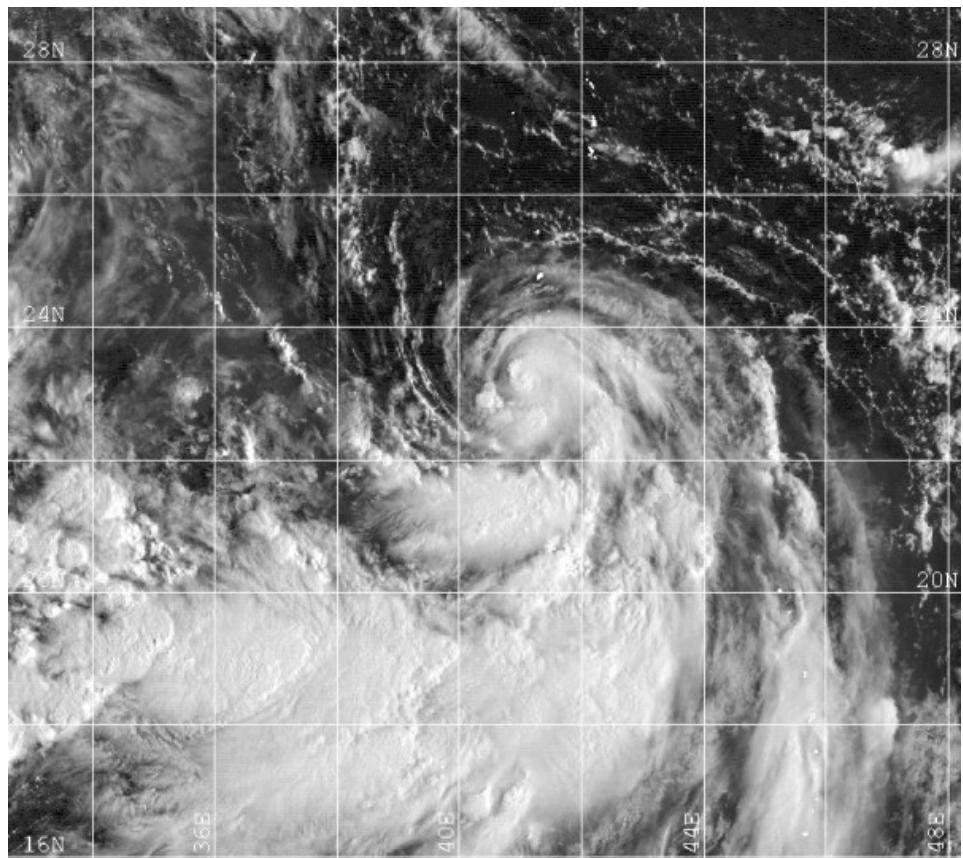


Figure 1-25W-2. 1422Z September 2000 GMS-5 visible image of TY 25W when the cyclone was located 120 nm southwest of Iwo Jima at tropical storm intensity.

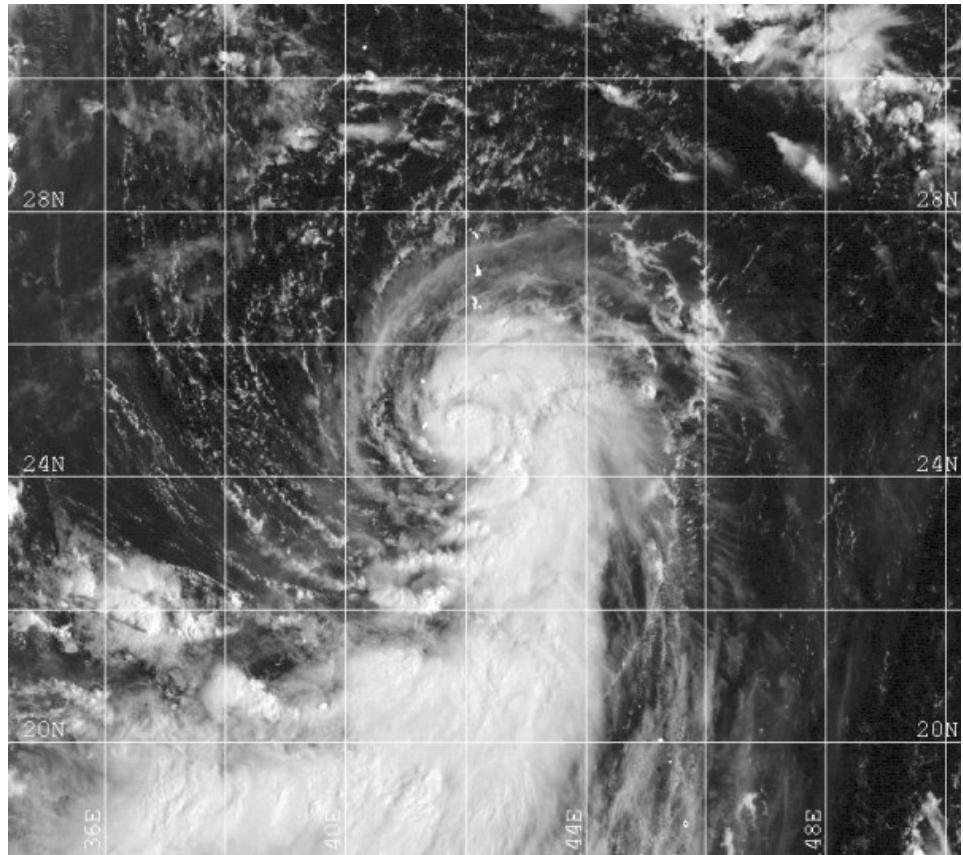


Figure 1-25W-3. 152301Z September 2000 GMS-5 visible image of TY 25W when the cyclone was located just southeast of Iwo Jima with a pinhole eye.

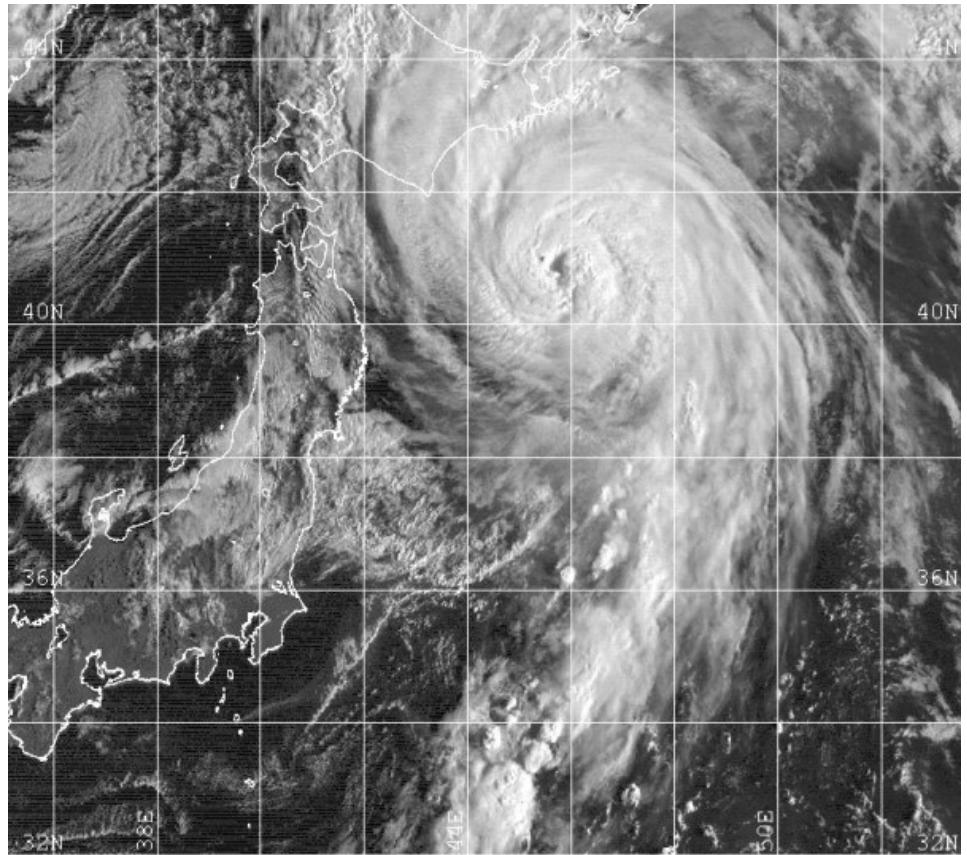
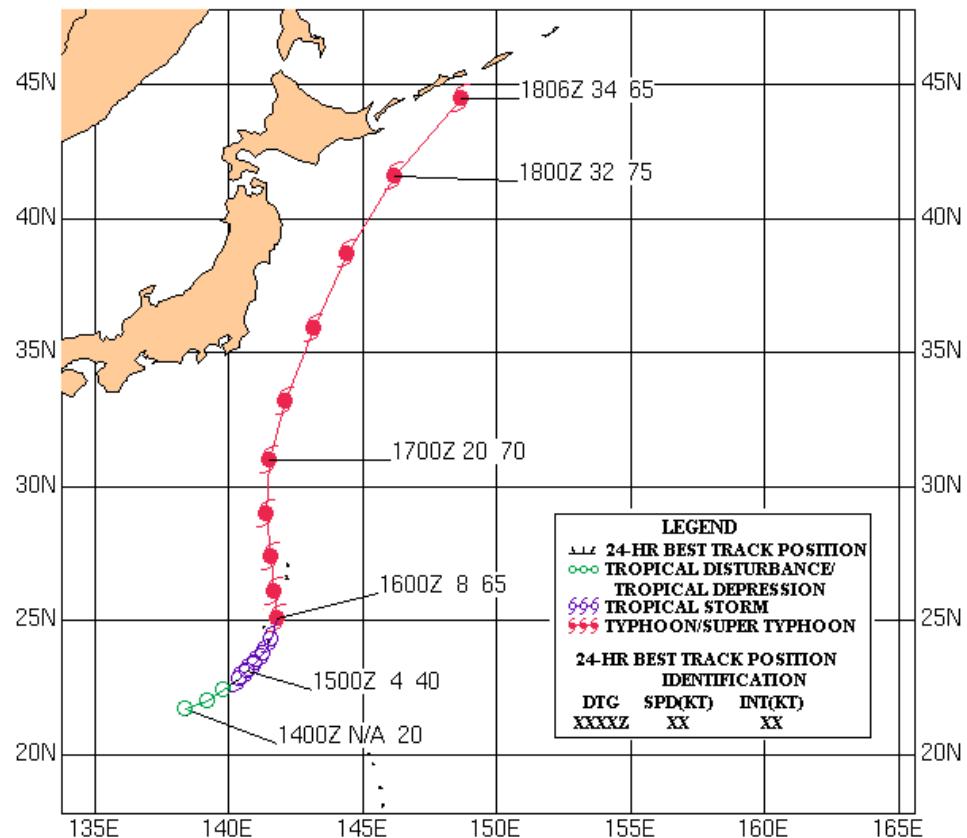


Figure 1-25W-4. 172131Z September 2000 GMS-5 visible image of TY 25W when the cyclone was located about 200 NM northeast of Misawa, Japan. Although an eye was evident, the low-level cloud pattern indicated that extratropical transition was beginning.

**TYPHOON 25W (SONAMU)**  
**14 - 18 SEPTEMBER 2000**



## **Super Typhoon (STY) 26W (Shanshan\*)**

First Poor : None

First Fair : 2030Z 15 Sep 00

First TCFA : 0230Z 16 Sep 00

First Warning : 1200Z 17 Sep 00

Last Warning : 0600Z 24 Sep 00

Max Intensity : 130 kts, Gusts to 160 kts

Landfall : None

Total Warnings : 28

Remarks : None

\* Name assigned by RSMC Tokyo

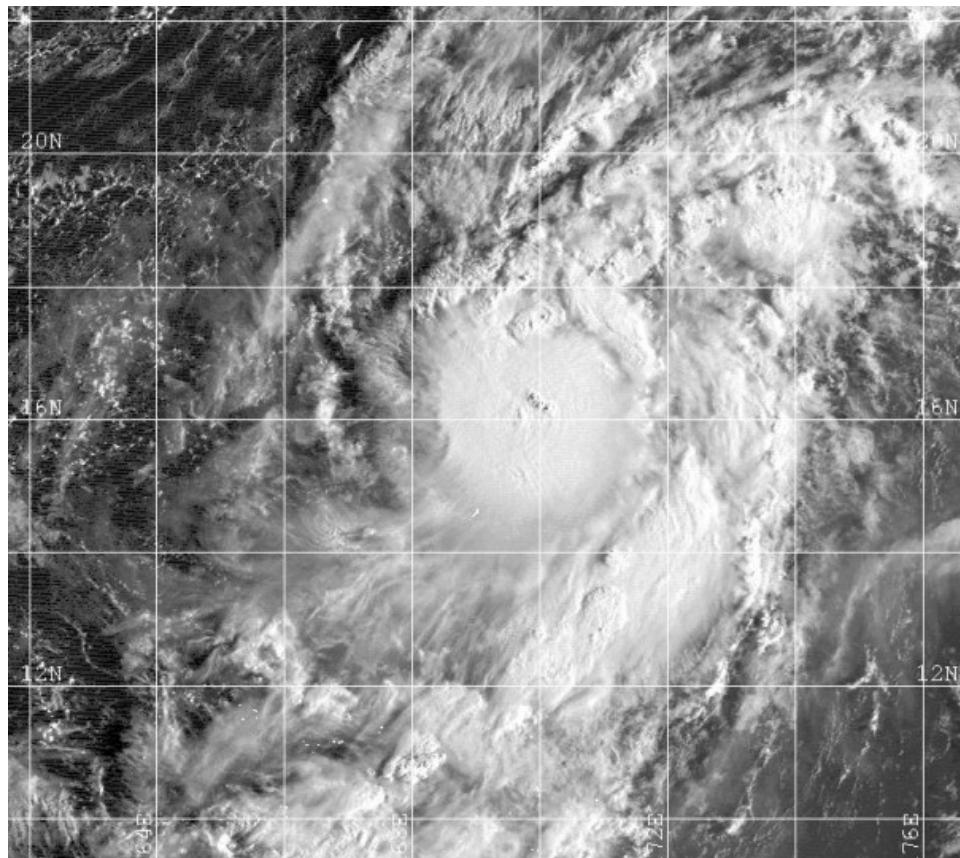


Figure 1-26W-1. 1819Z September 2000 GMS-5 visible image of STY 26W at tropical storm intensity, when the cyclone was located 265 nm southeast of Wake Island.

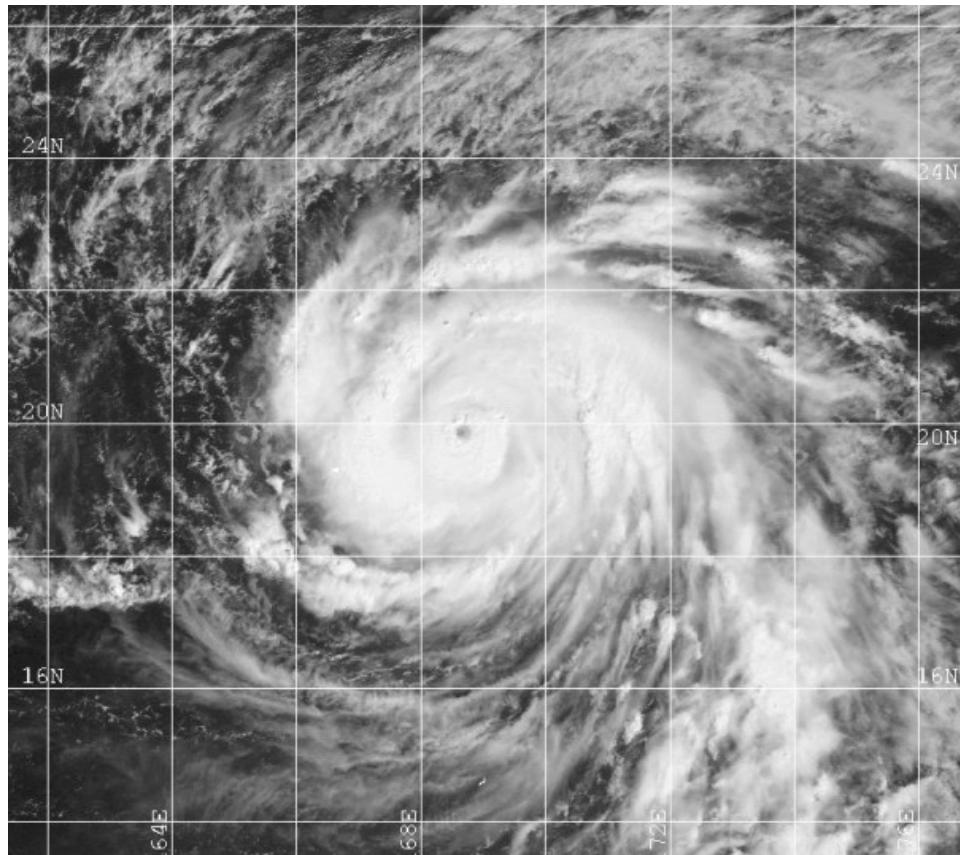


Figure 1-26W-2. 1922Z September 2000 GMS-5 visible image of STY 26W, located about 150 nm east of Wake Island with a small eye and deep convection throughout the eyewall. Several banding features can be seen around the core of the storm.

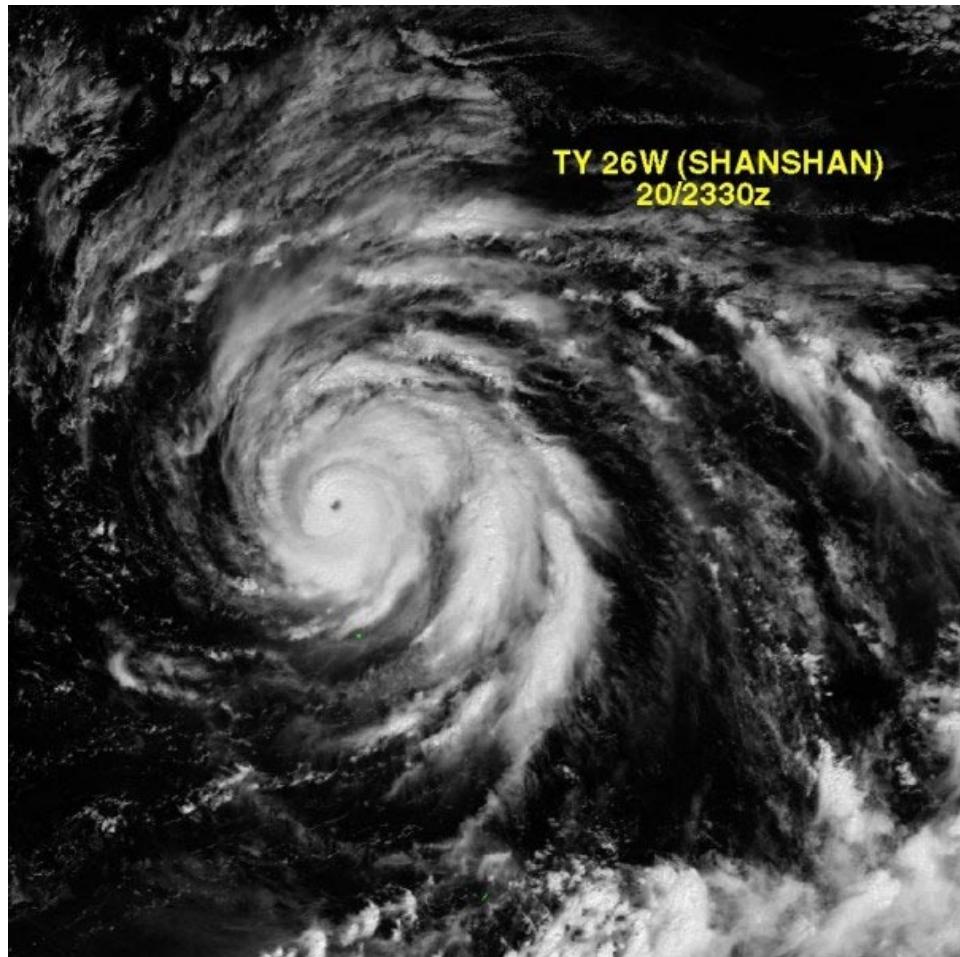


Figure 1-26W-3. 202330Z September 2000 GMS-5 visible image of STY 26W, located about 140 nm north of Wake Island with a clearly defined eye and principal banding features located on the eastern side of the cyclone.

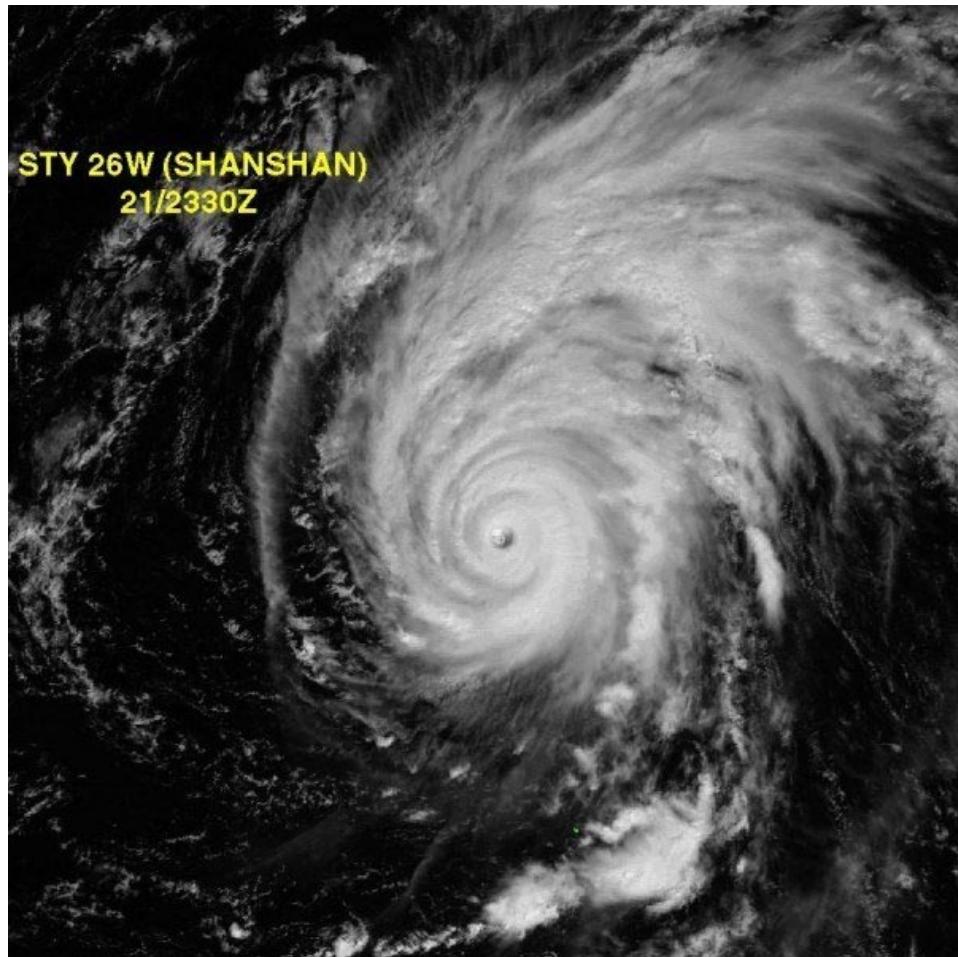


Figure 1-26W-4. 212330Z September 2000 GMS-5 visible image of STY 26W, located about 270 nm north-northwest of Wake Island at peak intensity of 135 knots. A clear, well-defined eye is evident with principal banding features on the northern periphery.

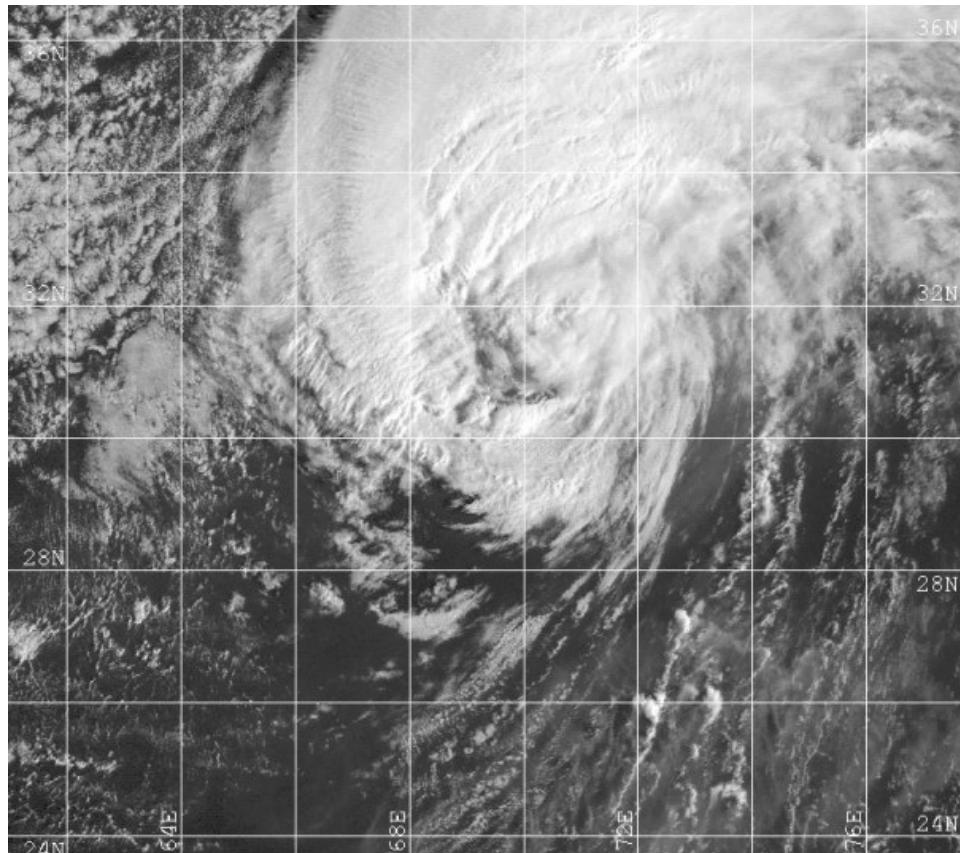
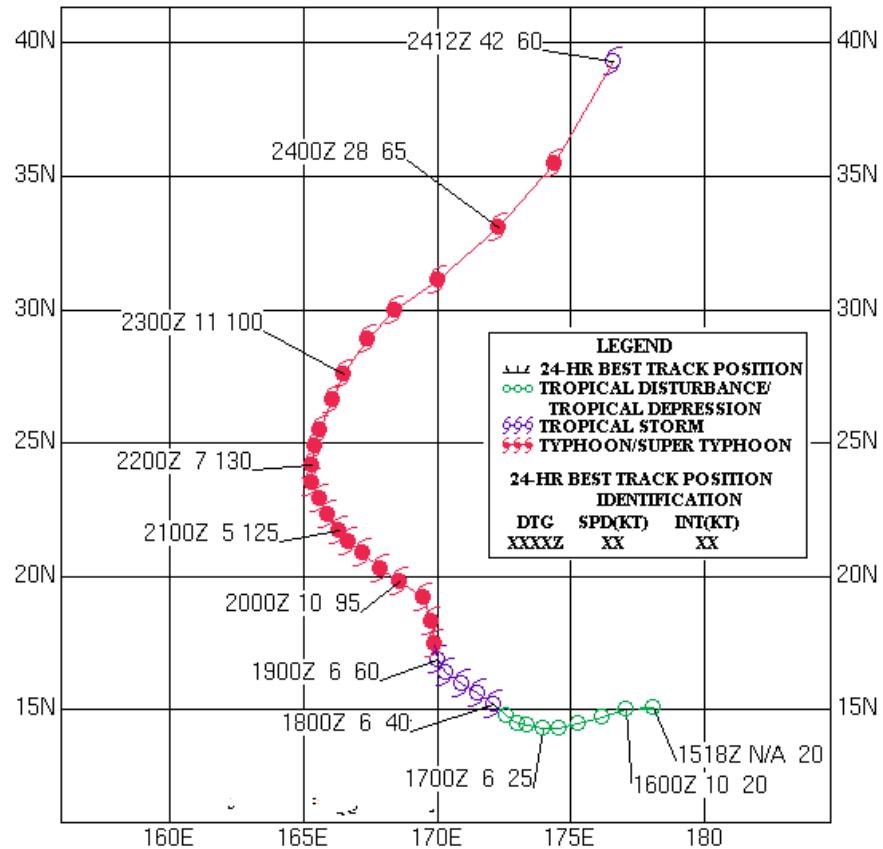


Figure 1-26W-5. 2320Z September 2000 GMS-5 visible image of STY 26W in the weakening phase when the cyclone was located 670 nm west-northwest of Midway Island. Convection is located to the northeast of the circulation center, which is partially exposed due to the increasing westerly vertical shear associated with a mid-latitude trough to the west.

**SUPER TYPHOON 26W (SHANSHAN)**  
**17 - 24 SEPTEMBER 2000**



## **Tropical Depression (TD) 27W**

First Poor : 0600Z 27 Sep 00

First Fair : 1430Z 27 Sep 00

First TCFA : 2230Z 27 Sep 00

First Warning : 1800Z 28 Sep 00

Last Warning : 0600Z 29 Sep 00

Max Intensity : 30 kts, Gusts to 40 kts

Landfall : None

Total Warnings : 7

Remarks : None

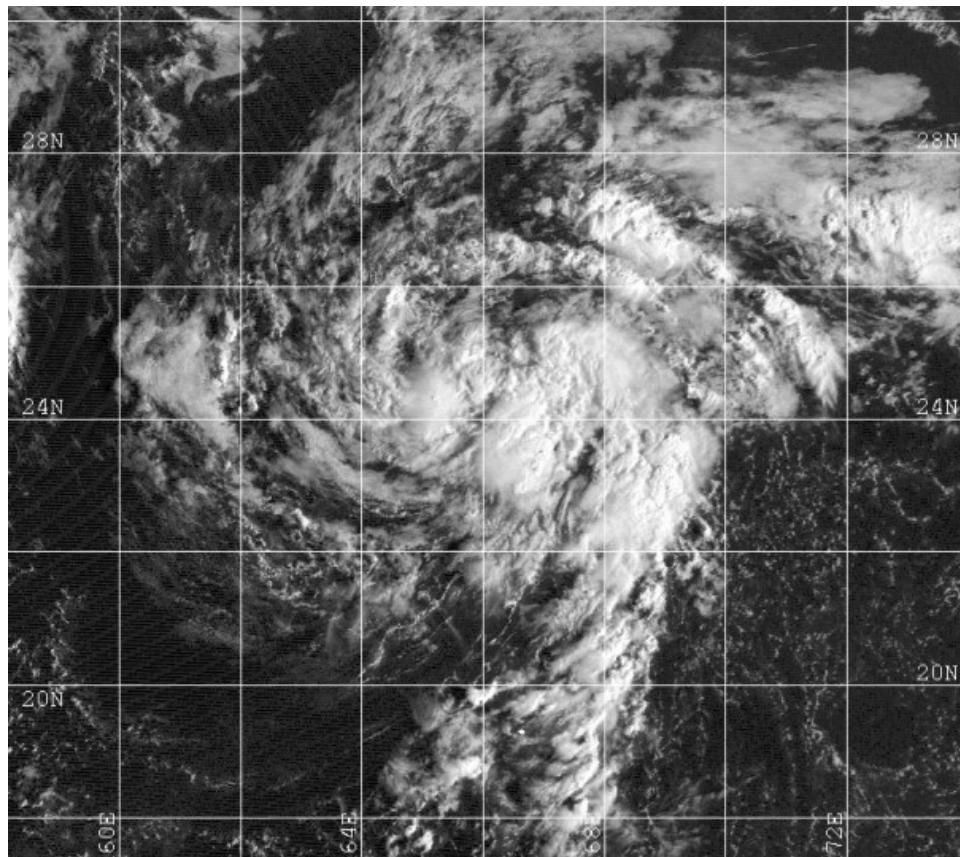


Figure 1-27W-1. 272031Z September 2000 GMS-5 visible image of TD 27W when it was located 295 nm north-northwest of Wake Island. Convection is concentrated east of the circulation center, and the low-level circulation can be seen along the southern periphery.

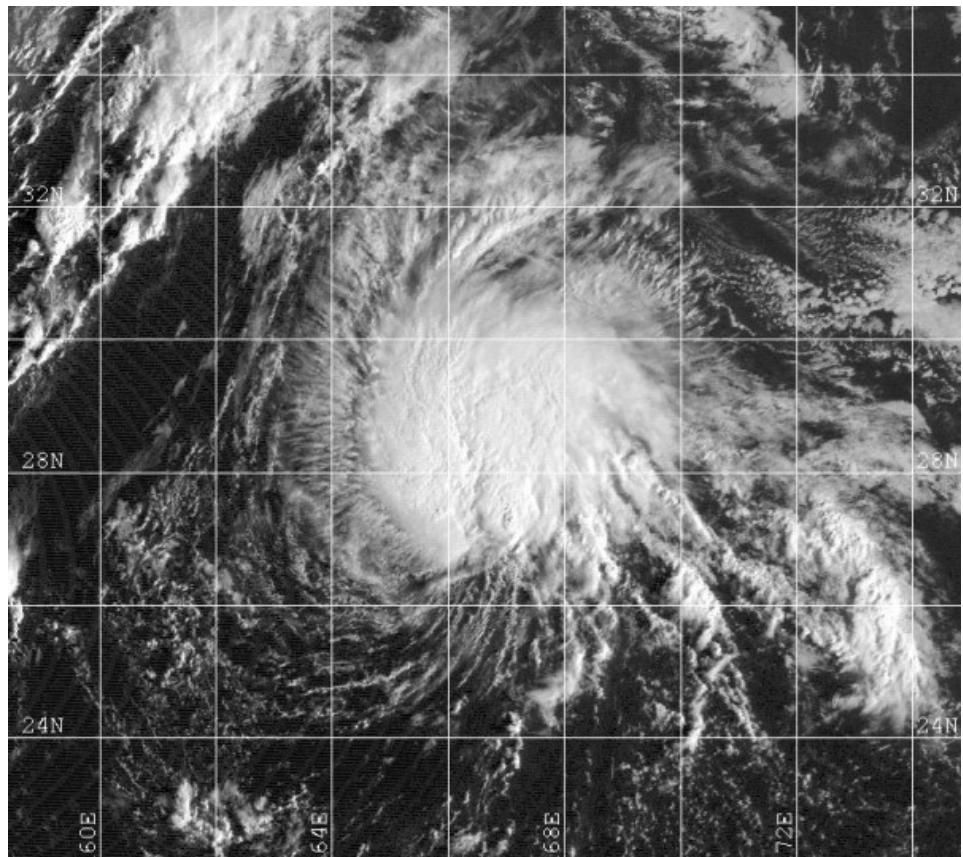


Figure 1-27W-2. 282031Z September 2000 GMS-5 visible image of TD 27W, located about 450 nm north-northwest of Wake Island with a partially exposed low-level circulation center south of the deep convection.

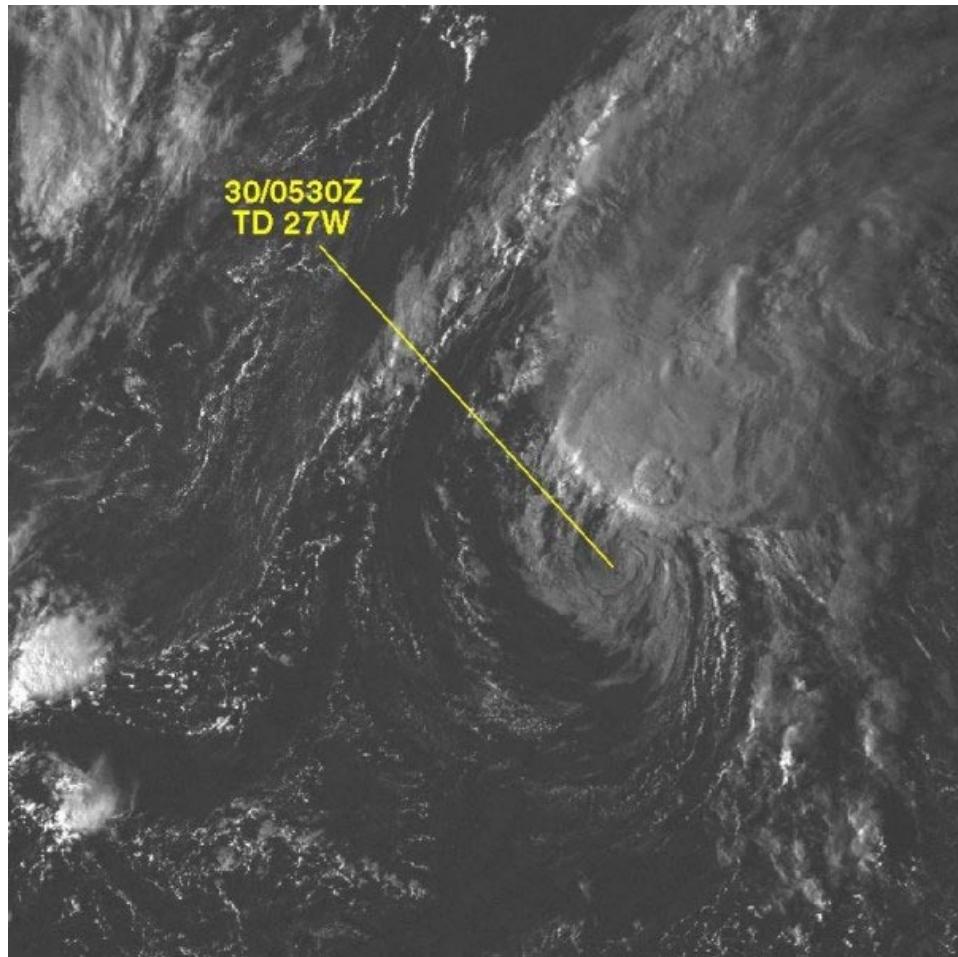
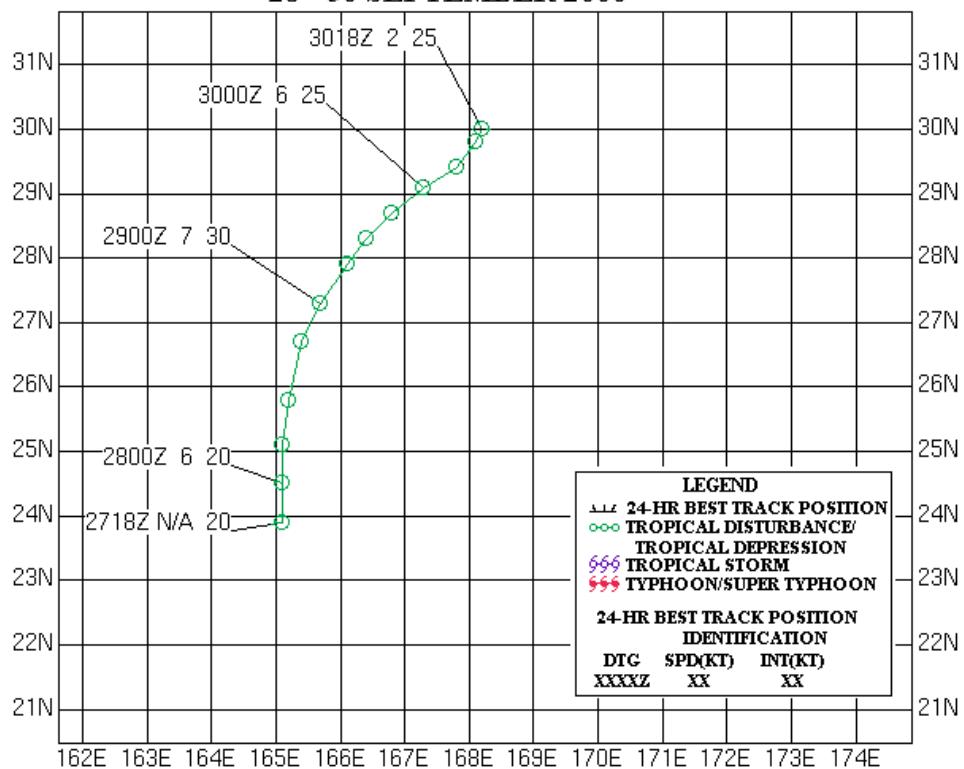


Figure 1-27W-3. 300530Z September 2000 GMS-5 visible image of TD 27W, located about 600 nm north of Wake Island with an exposed low-level circulation center and deep convection displaced to the north-northeast of the center.

**TROPICAL DEPRESSION 27W**  
**28 - 30 SEPTEMBER 2000**



## **Tropical Storm (TS) 28W**

First Poor : 0600Z 04 Oct 00

First Fair : 1930Z 04 Oct 00

First TCFA : None

First Warning : 1800Z 06 Oct 00

Last Warning : 0600Z 13 Oct 00

Max Intensity : 40 kts, Gusts to 50 kts

Landfall : None

Total Warnings : 27

Remarks : None

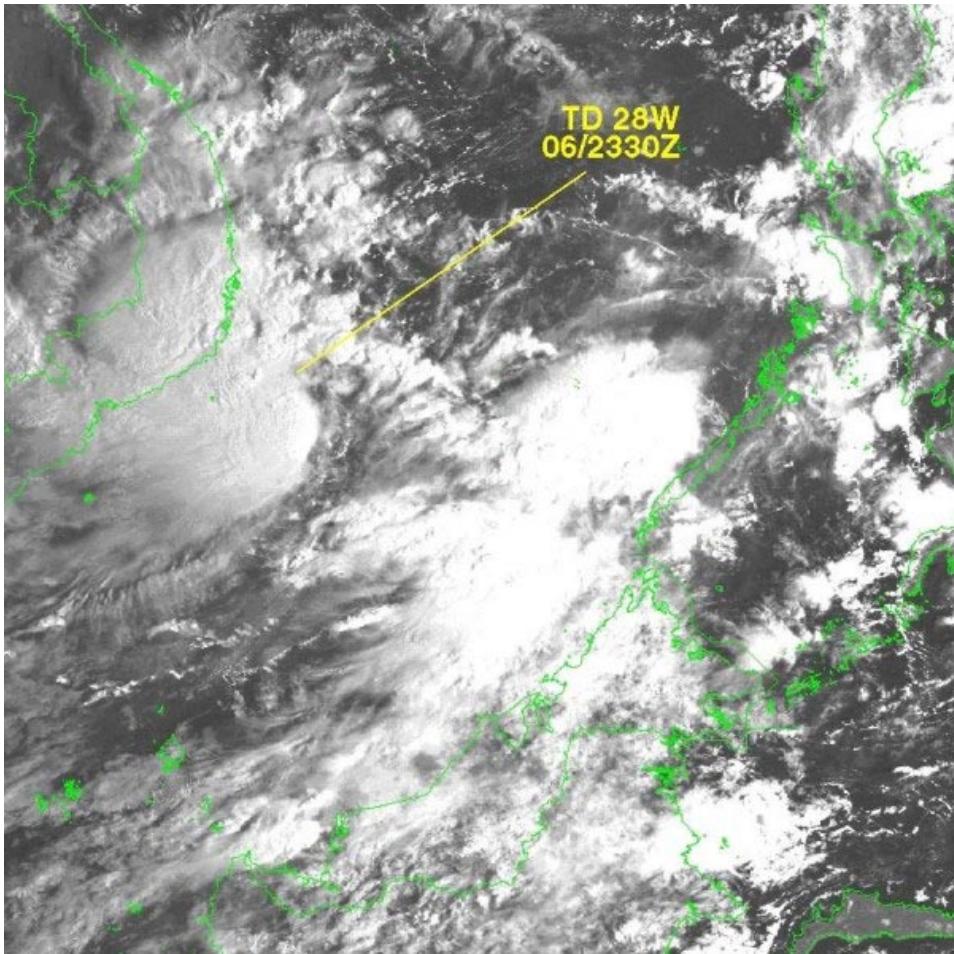


Figure 1-28W-1. 062330Z September 2000 GMS-5 visible image of TS 28W, when the cyclone was located east-southeast of Cam Ranh Bay, Vietnam at tropical depression intensity.

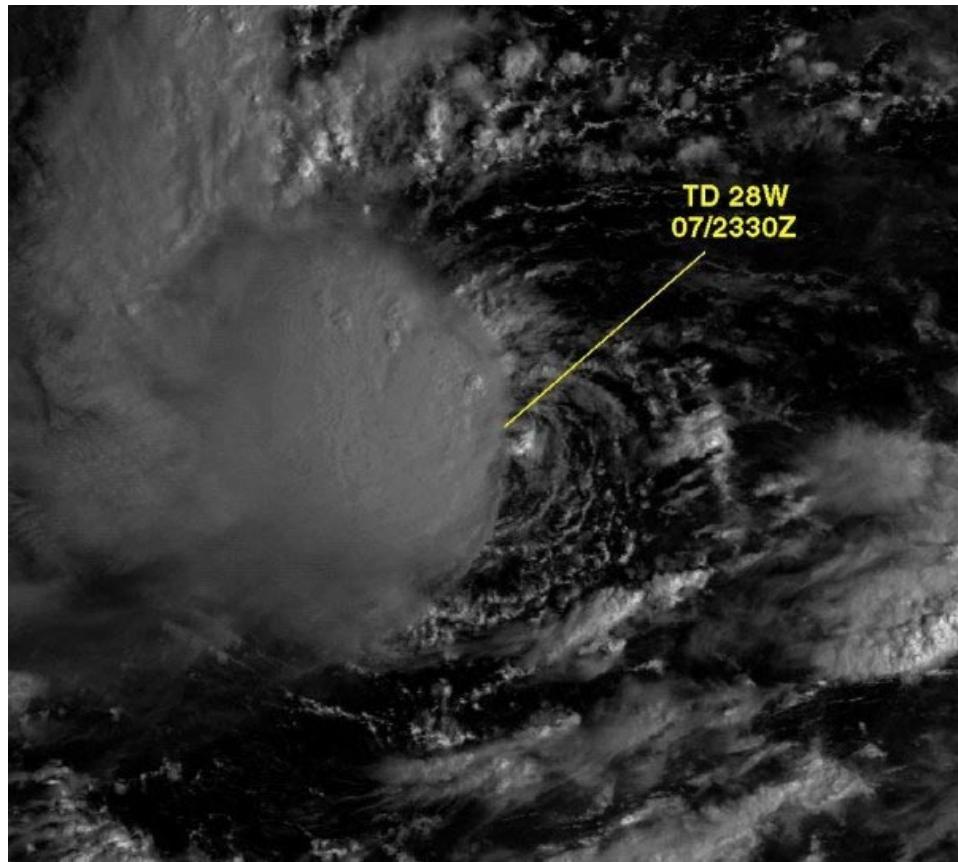
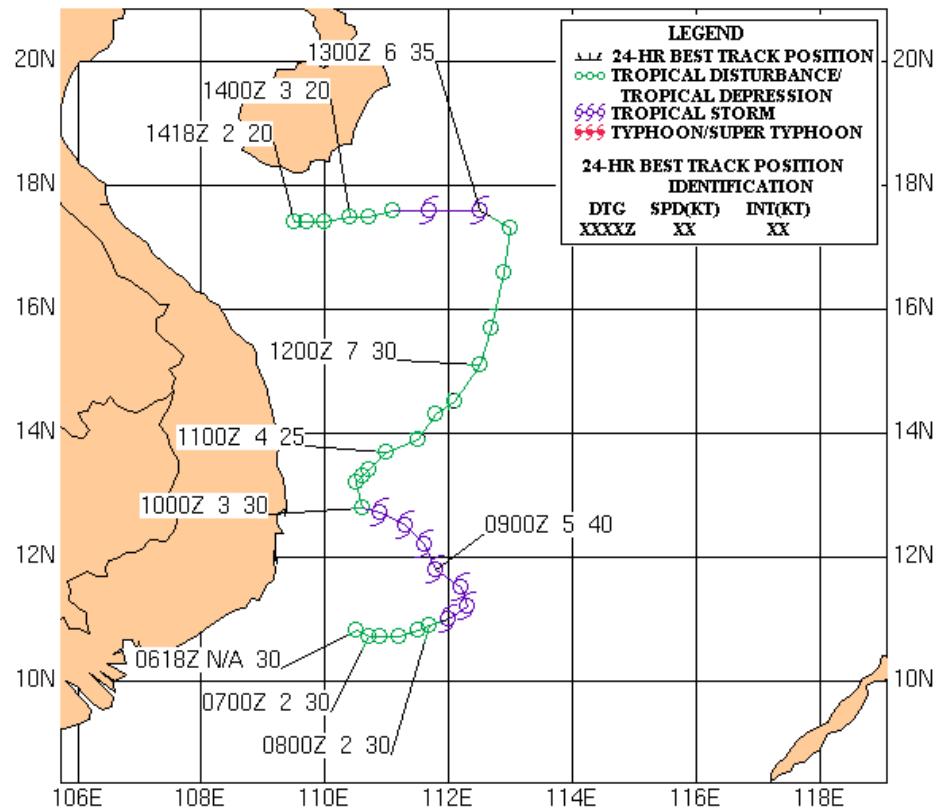


Figure 1-28W-2. 072330Z September 2000 GMS-5 visible image of TS 28W located about 130 nm east-southeast of Cam Rahn Bay, Vietnam. The low-level circulation center is exposed as a result of easterly shear, with most of the convection concentrated on the western periphery of the low-level circulation.

**TROPICAL STORM 28W  
06 - 13 OCTOBER 2000**



## Typhoon (TY) 29W (Yagi\*)

First Poor : 0600Z 20 Oct 00

First Fair : 1400Z 20 Oct 00

First TCFA : 0830Z 21 Oct 00

First Warning : 1800Z 21 Oct 00

Last Warning : 0600Z 28 Oct 00

Max Intensity : 105 kts, Gusts to 130 kts

Landfall : None

Total Warnings : 27

Remarks :

- (1) TY 29W underwent a period of rapid intensification beginning at 0600Z 24 Oct, intensifying 35 kts (from 65 kts to 105 kts) in 12 hours.
- (2) The cyclone moved in an anticyclonic loop just west of Okinawa.

\* Name assigned by RSMC Tokyo

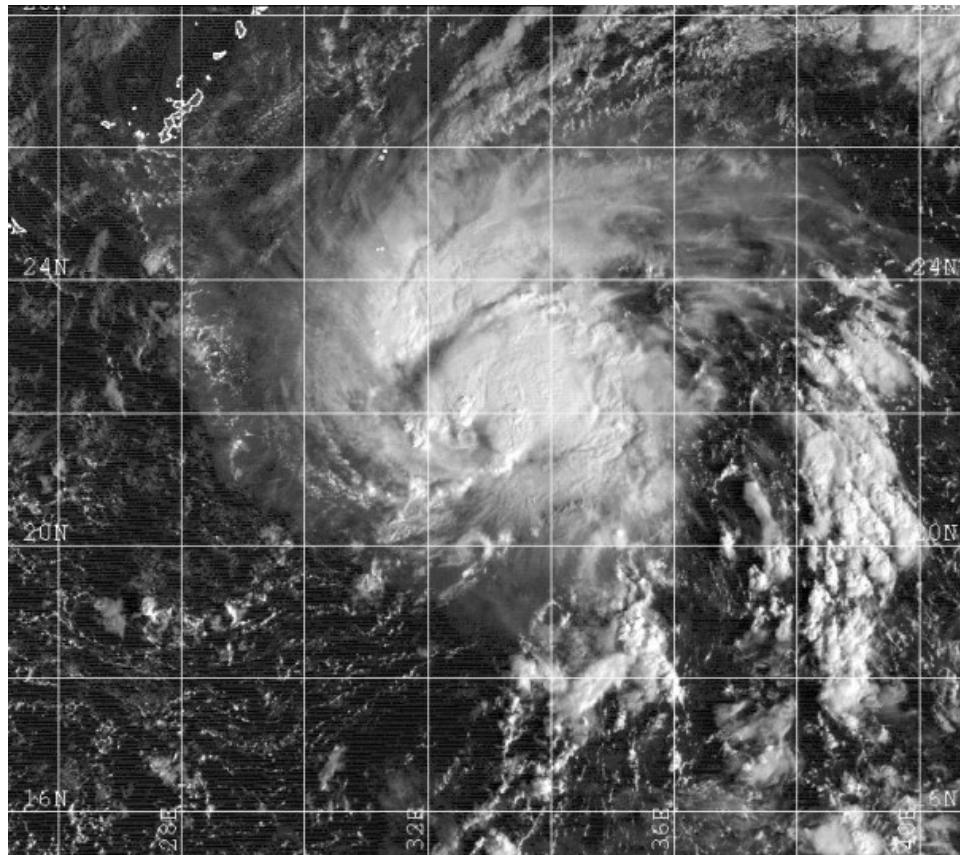


Figure 1-29W-1. 222202Z October 2000 GMS-5 visible image of TY 29W, located approximately 400 nm southeast of Naha, Japan, with convection concentrated in the northwest-northeast quadrants.

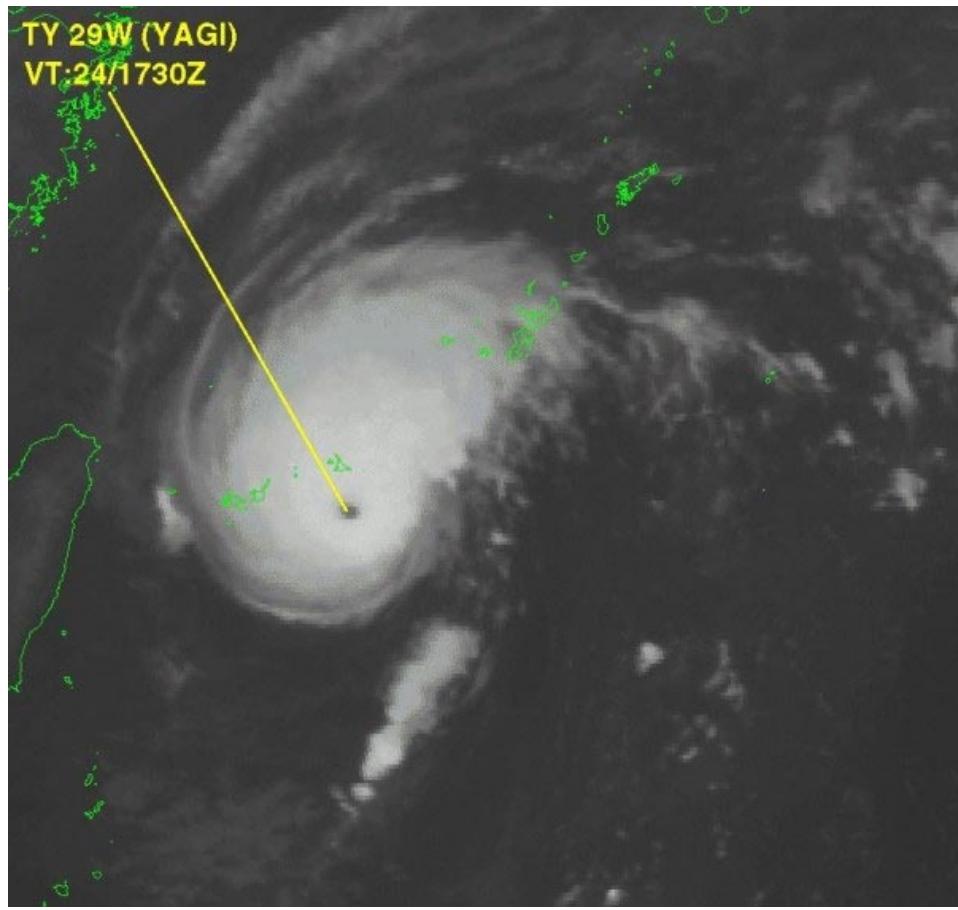


Figure 1-29W-2. 241730Z October 2000 GMS-5 infrared image of TY 29W, located 50 nm south of Miyako Island, Japan. The storm is near peak intensity of 105 knots, with a cloud-free eye.

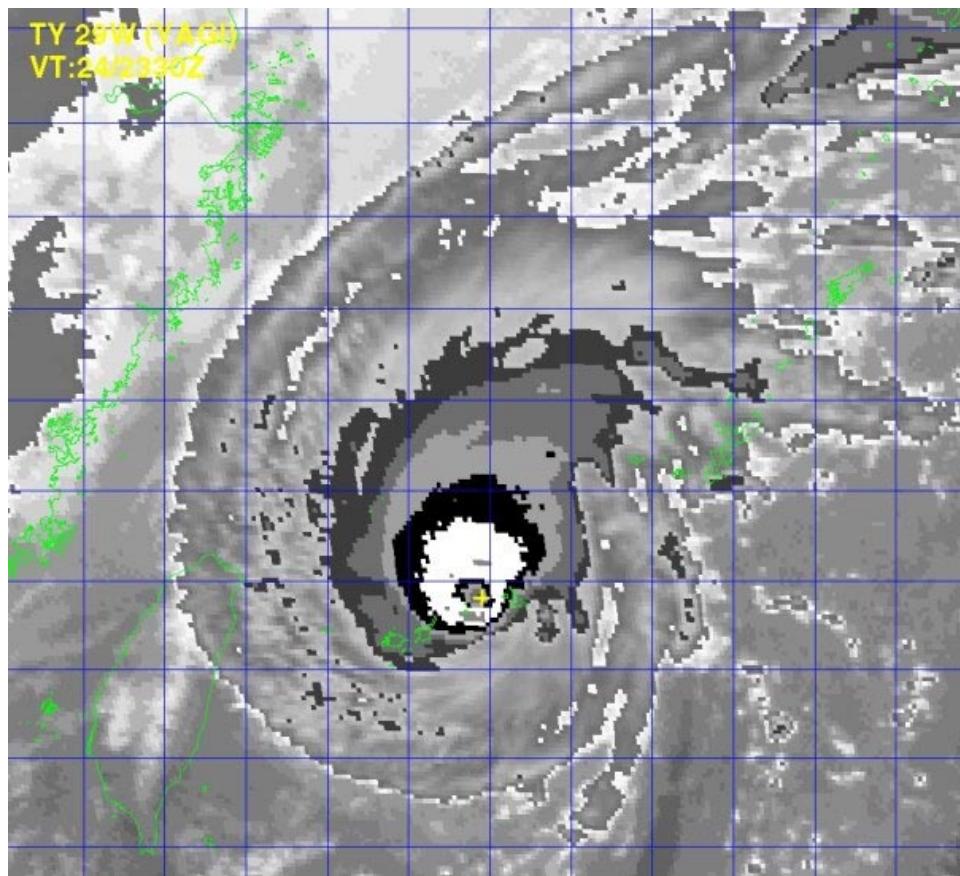


Figure 1-29W-3. 242330Z October 2000 GMS-5 infrared image of TY 29W, located 20 nm west of Miyako Island, Japan, with a cloud-free eye.

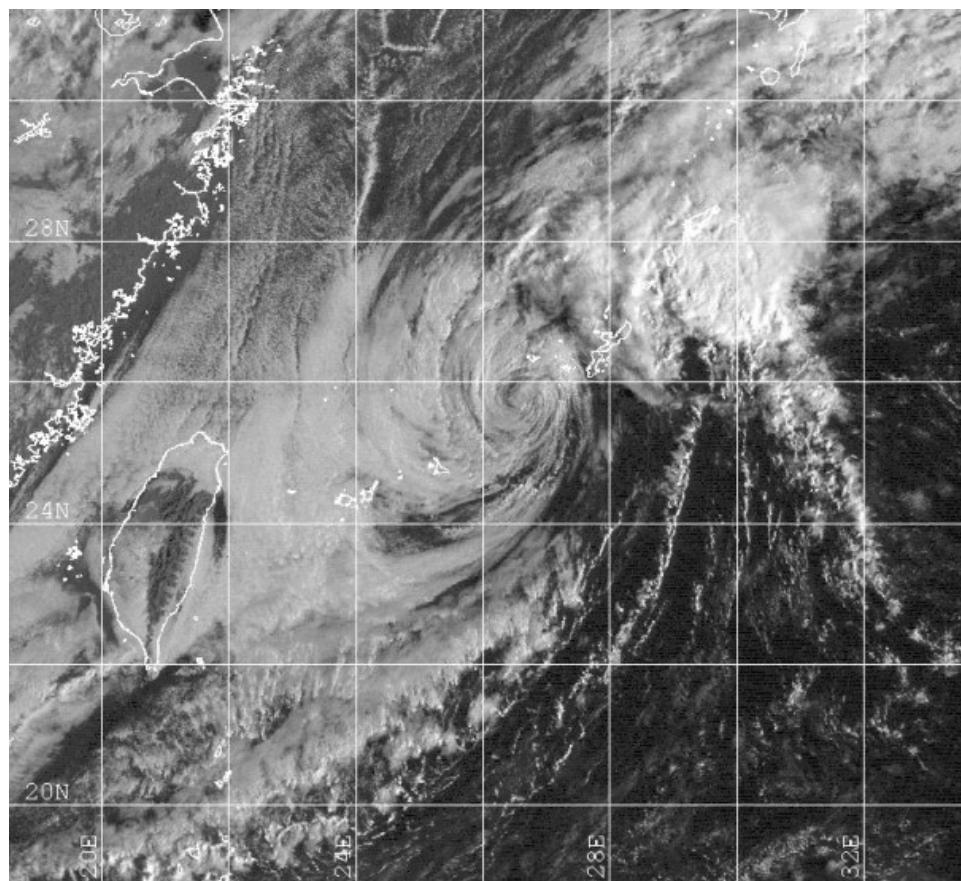
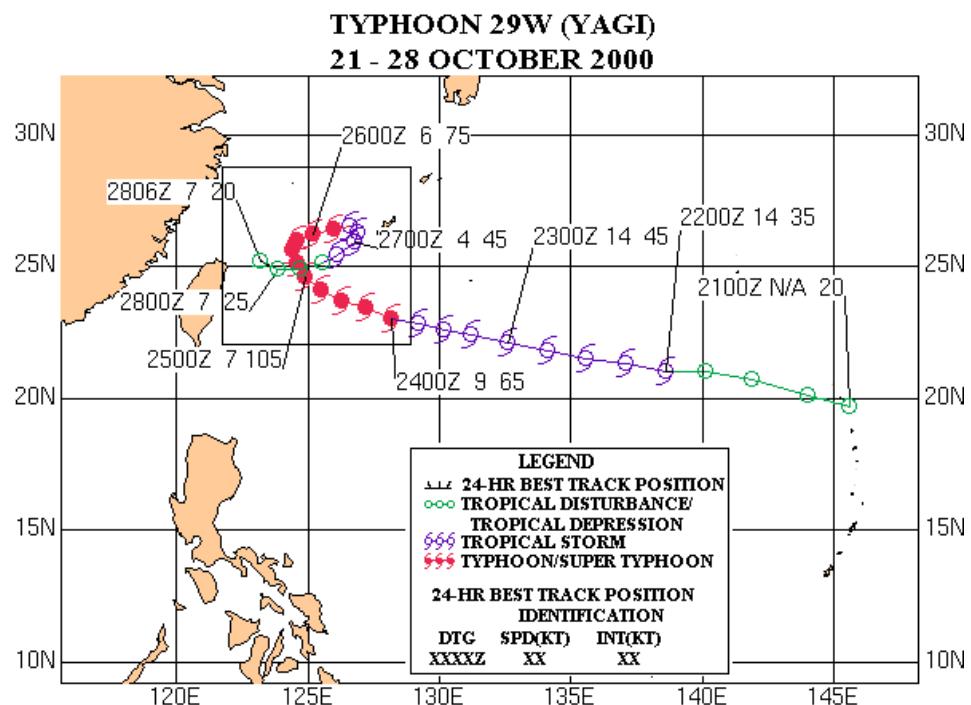
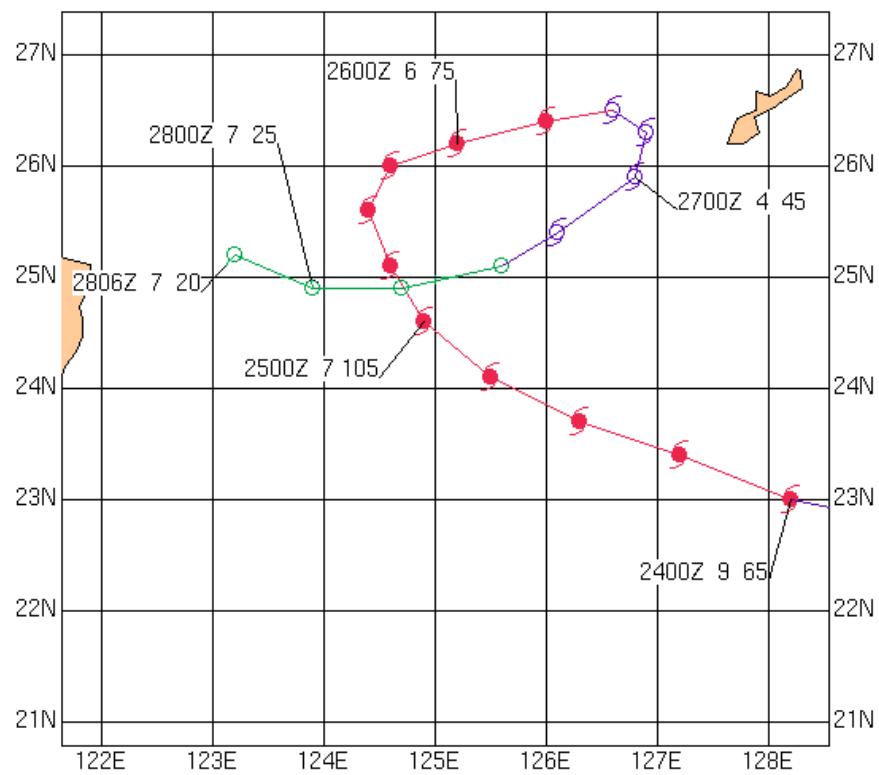


Figure 1-29W-4. 262301Z October 2000 GMS-5 visible image of TY 29W, located 50 nm southwest of Naha, Japan, with a fully exposed low-level circulation center and deep convection displaced 180 nm to the northeast.



See below to view inset detail



## **Typhoon (TY) 30W (Xangsane\*)**

First Poor : 0600Z 24 Oct 00

First Fair : 0030Z 25 Oct 00

First TCFA : 0530Z 25 Oct 00

First Warning : 1200Z 25 Oct 00

Last Warning : 1800Z 01 Nov 00

Max Intensity : 90 kts, Gusts to 110 kts

Landfall : 1800Z 27 Oct 00 over Southern Luzon, Philippines

Total Warnings : 30

Remarks :

- (1) The Associated Press (AP) reported TY 30W killed 40 people, left 100,000 homeless, and caused damages estimated at \$27.45 million in the Philippines.
- (2) TY 30W tracked parallel to the east coast of Taiwan at typhoon intensity. The AP reported that flooding led to 59 deaths on the island, with damage estimated at \$500 million.
- (3) Reuters reported a Singapore airlines plane crashed while attempting to take off on a closed runway at Taipei as TY 30W skirted the coast of Taiwan, killing 82 of the 179 passengers. Poor visibility caused by TY 30W may have been a factor.

\* Name assigned by RSMC Tokyo

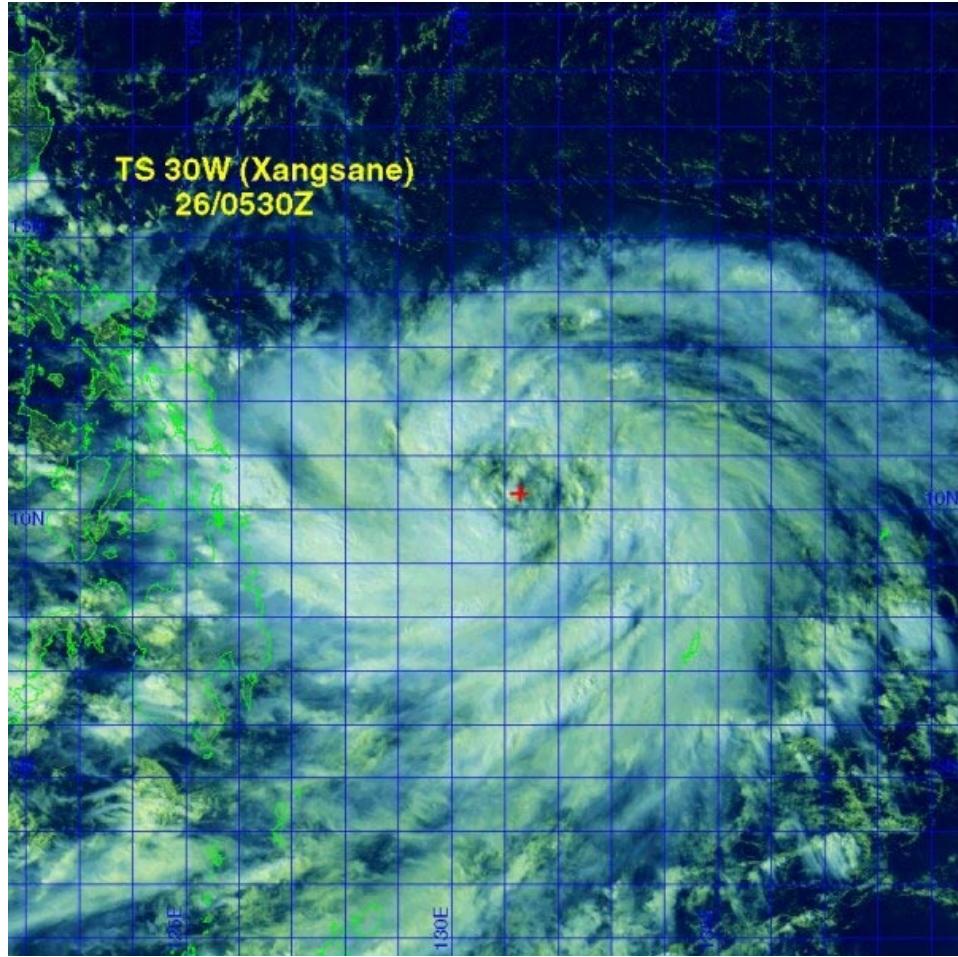


Figure 1-30W-1. 260530Z October 2000 multi-spectral image of TY 30W, located about 280 nm east of Mindanao, at an estimated intensity of 55 kts.

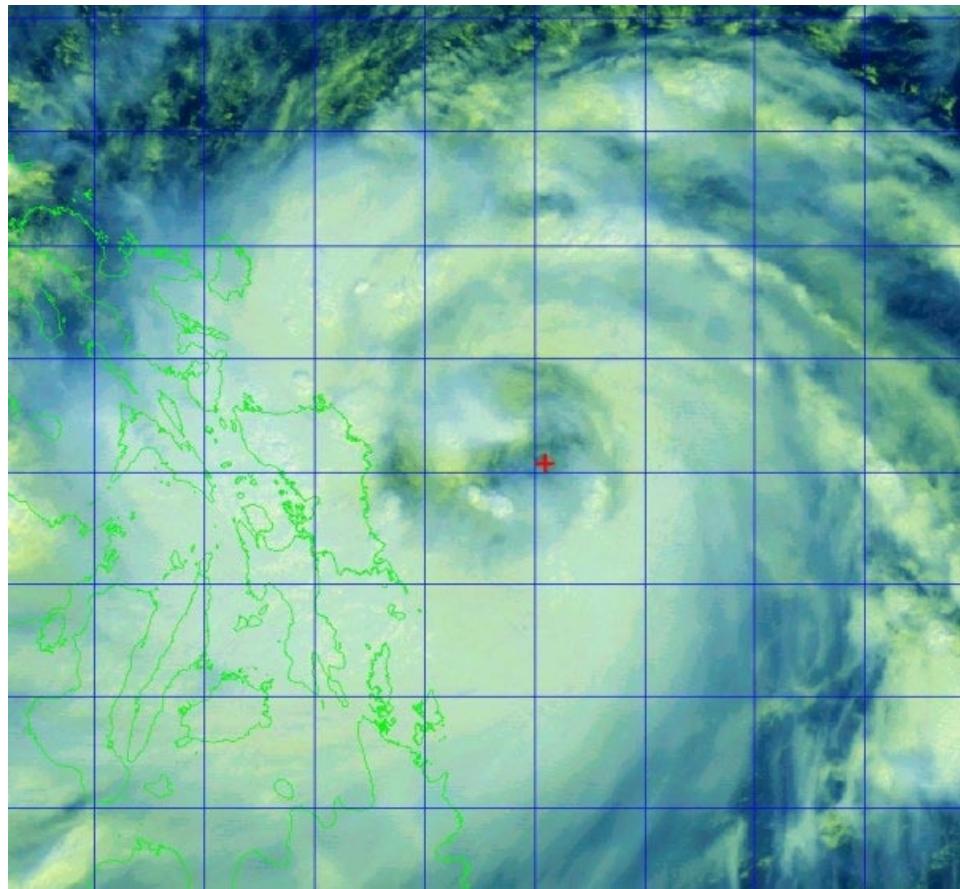


Figure 1-30W-2. 270230Z October 2000 multi-spectral image of TY 30W, located 200 nm north-east of Surigao, Philippines, at an estimated intensity of 65 kts.

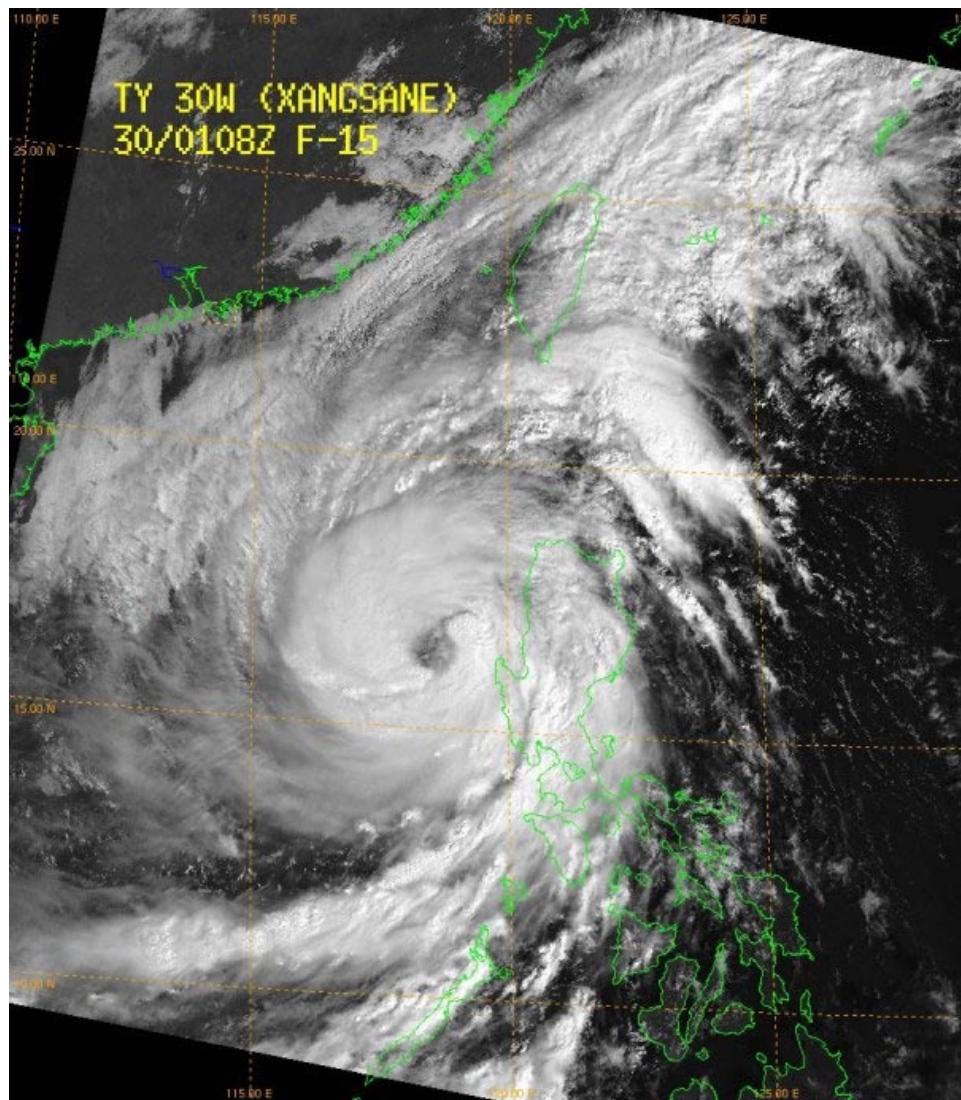


Figure 1-30W-3. 300108Z October 2000 DMSP visible image of TY 30W, located 360 nm south-southwest of Taiwan, with a well-developed eye and an estimated intensity of 90 knots.

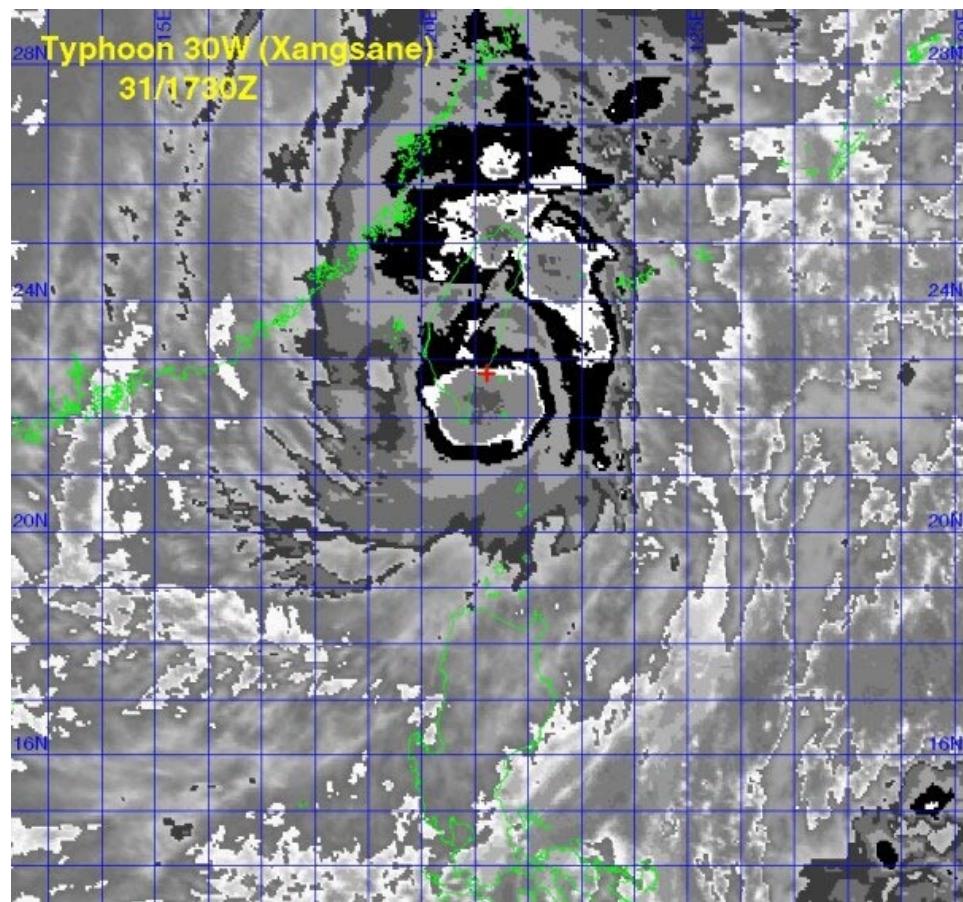


Figure 1-30W-4. 311730Z October 2000 GMS-5 enhanced infrared image of TY 30W, located just off the southeast coast of Taiwan.

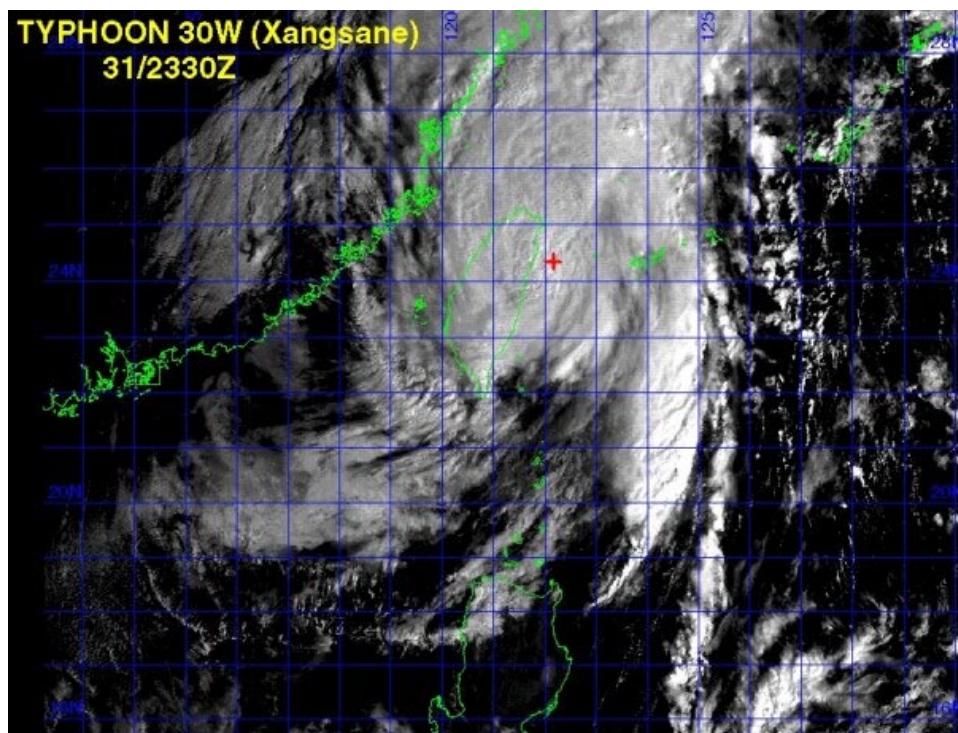
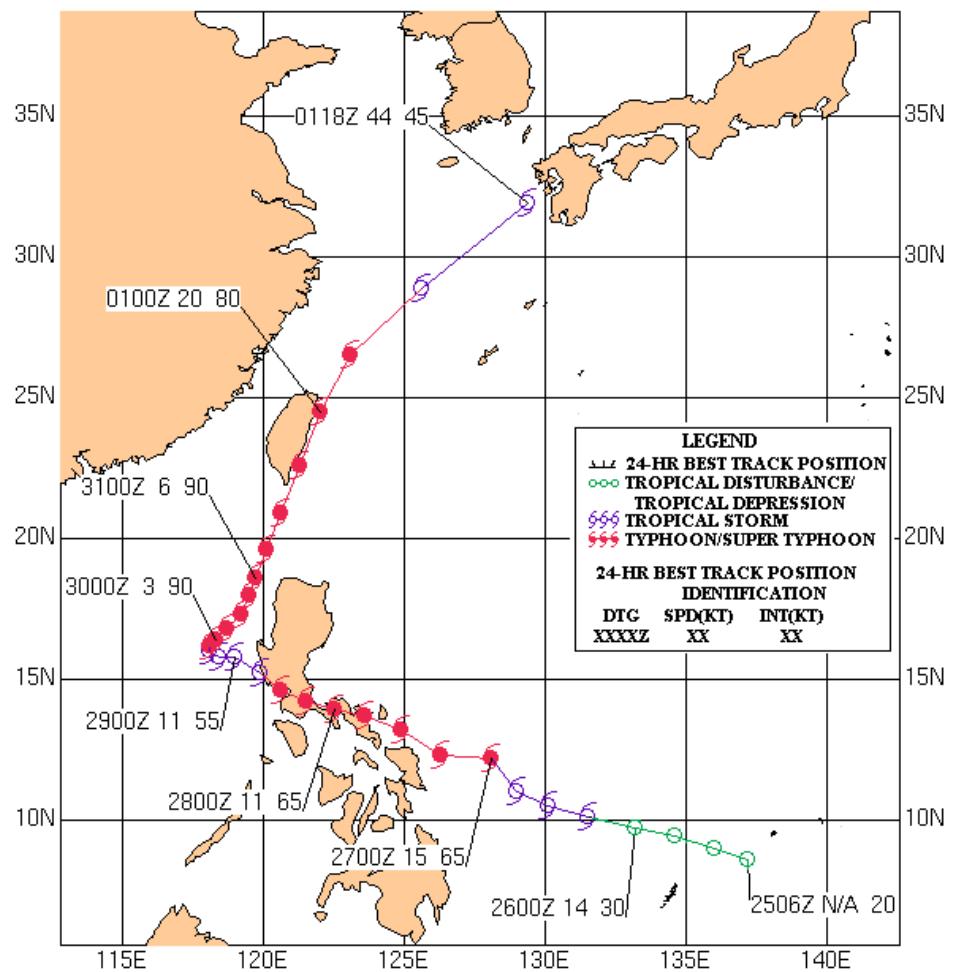


Figure 1-30W-5. 312330Z October 2000 GMS-5 visible image of TY 30W, located just off the east coast of Taiwan. At this time, the cyclone has a broad circulation and appears to have begun extra-tropical transition.

**TYPHOON 30W (XANGSANE)**  
**25 OCTOBER - 01 NOVEMBER 2000**



## **Typhoon (TY) 31W (Bebinca\*)**

First Poor : 0600Z 28 Oct 00

First Fair : 0600Z 30 Oct 00

First TCFA : 2200Z 30 Oct 00

First Warning : 0000Z 31 Oct 00

Last Warning : 0000Z 08 Nov 00

Max Intensity : 85 kts, Gusts to 105 kts

Landfall : 1600Z 02 Nov 00 over Luzon, Philippines.

Total Warnings : 33

Remarks:

(1) The Associated Press reported that 26 people were killed when TY 31W tracked over Luzon, Phillipines.

\* Name assigned by RSMC Tokyo

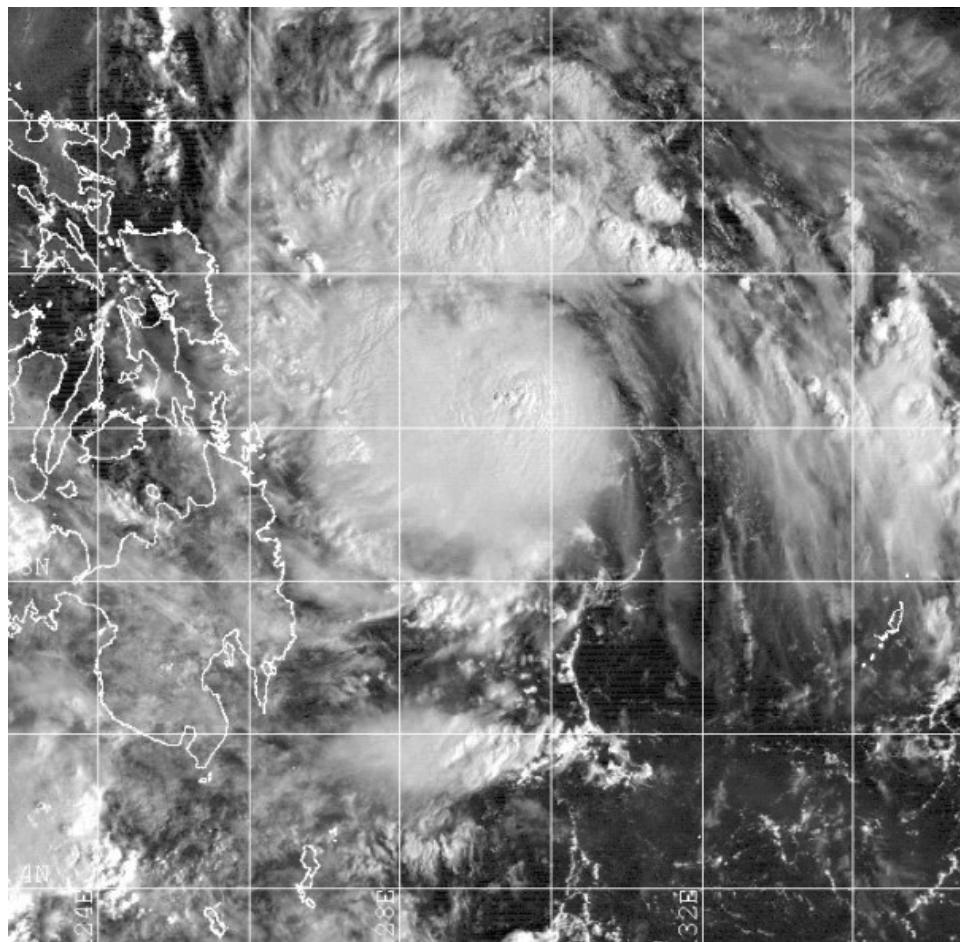


Figure 1-31W-1. 312224Z October 2000 GMS-5 visible image of TY 31W at tropical depression intensity, when the cyclone was located 310 nm east-southeast of Surigao, Philippines.

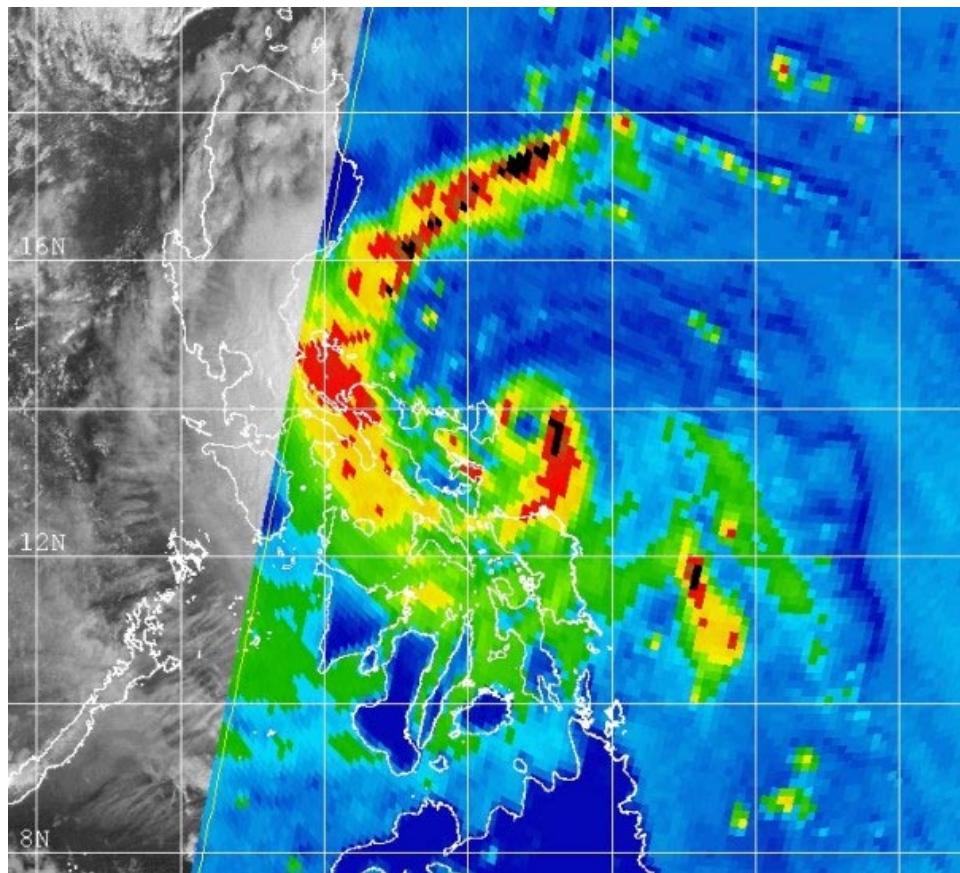


Figure 1-31W-2. 012331Z November 2000 SSMI 85 GHz image of TY 31W, when the cyclone was located just east of Catanduanes Island, Philippines. At this time, the cyclone has an estimated intensity of 55 knots.

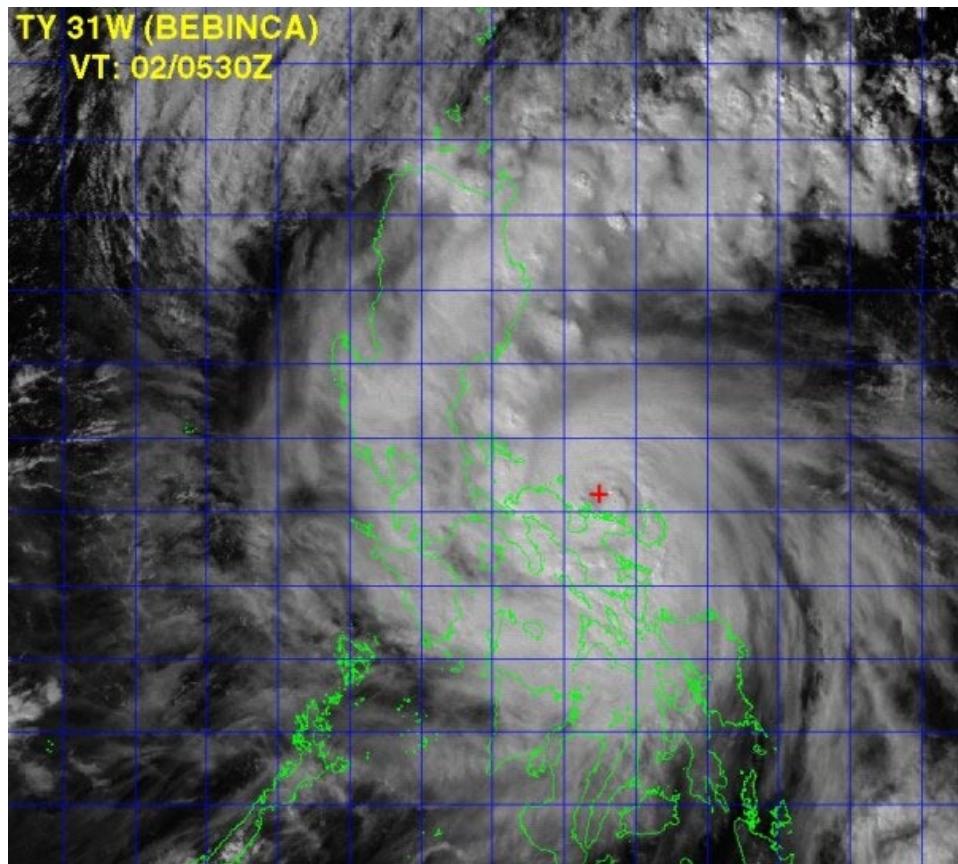


Figure 1-31W-3. 020530Z November 2000 GMS-5 visible image of TY 31W, when the cyclone was located approximately 210 nm east-southeast of Manila, Philippines, with a developing eye.

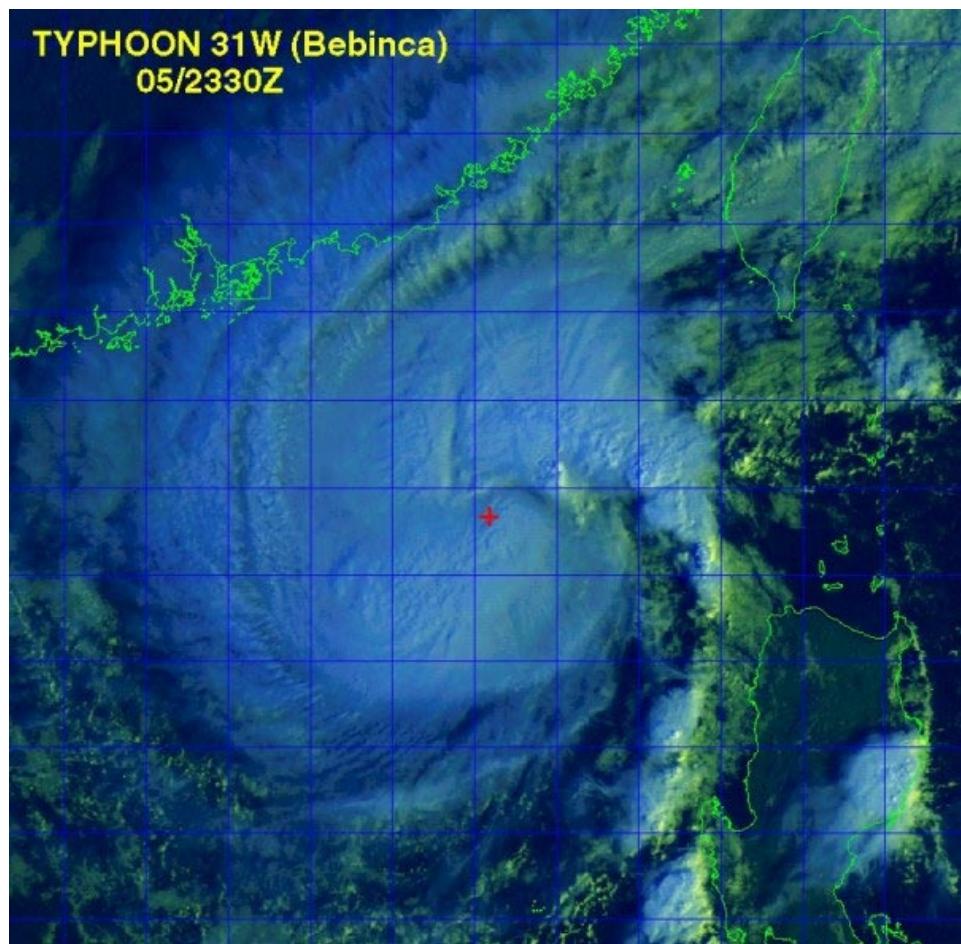


Figure 1-31W-4. 052330Z November 2000 multi-spectral image of TY 31W, located about 230 nm south-southeast of Hong Kong with an estimated intensity of 65 knots.

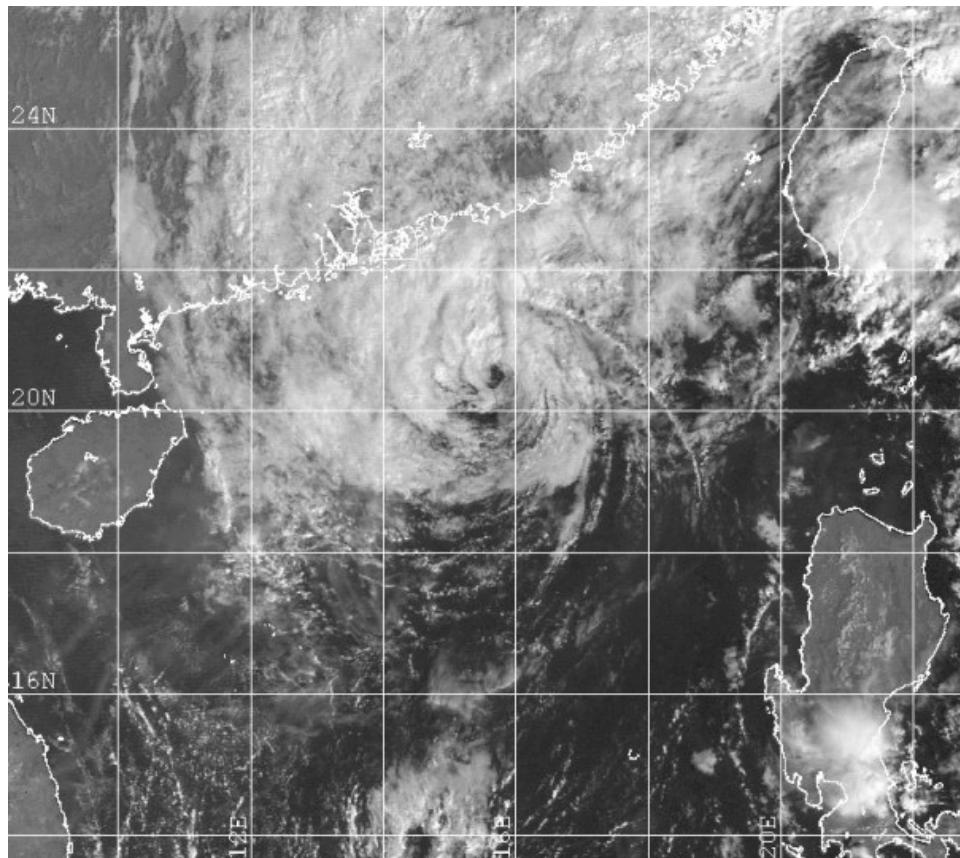
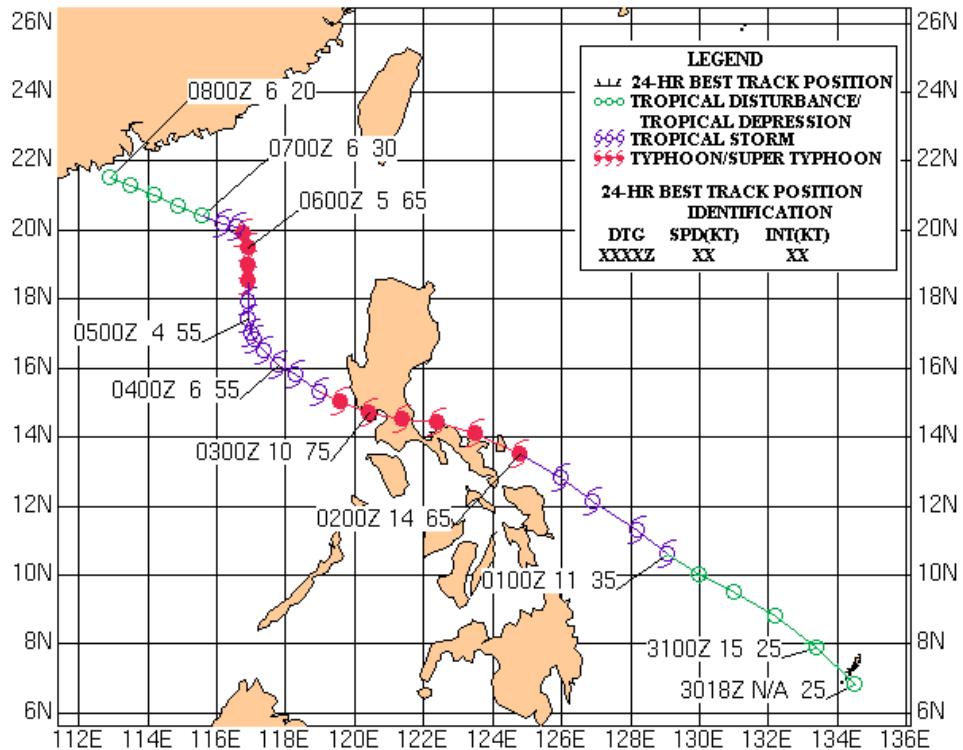


Figure 1-31W-5. 0700Z November 2000 GMS-5 visible image of TY 31W, located south of Hong Kong with a completely exposed low-level circulation.

**TYPHOON 31W (BEBINCA)**  
**31 OCTOBER - 08 NOVEMBER 2000**



## **Tropical Depression (TD) 32W**

First Poor : 0600Z 06 Nov 00

First Fair : 0600Z 07 Nov 00

First TCFA : 2200Z 07 Nov 00

First Warning : 0000Z 08 Nov 00

Last Warning : 1800Z 09 Nov 00

Max Intensity : 30 kts, Gusts to 40 kts

Landfall : None

Total Warnings : 8

Remarks : None

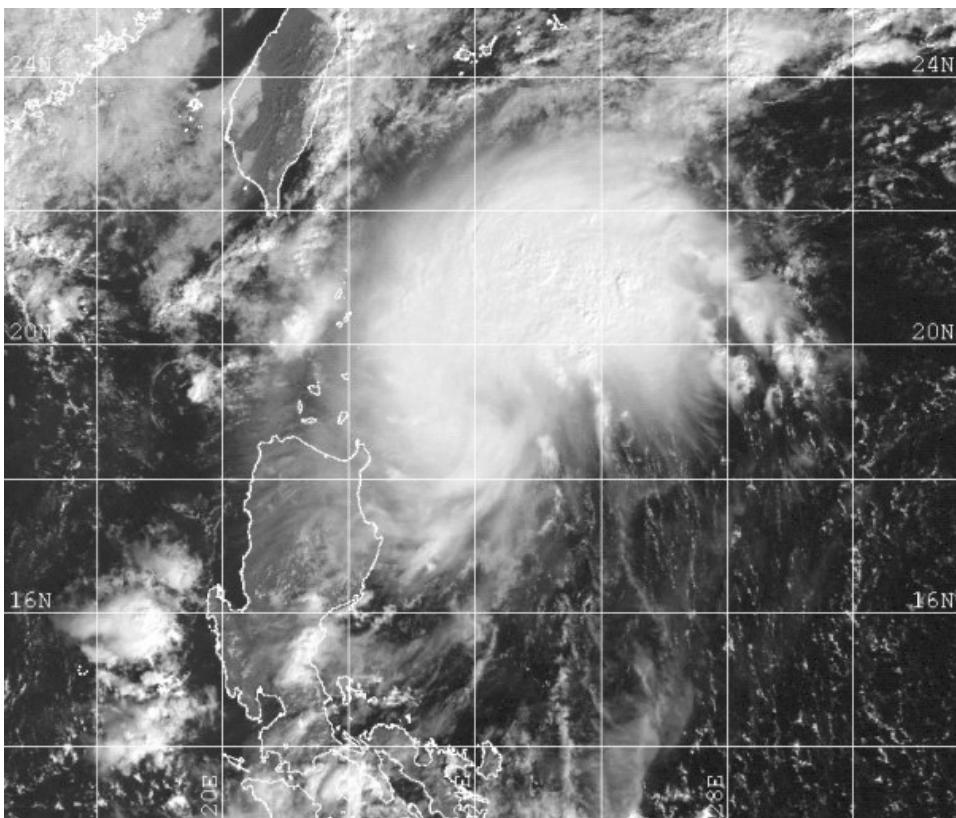


Figure 1-32W-1. 080031Z November 2000 GMS-5 visible image of TD 32W, located about 180 nm southeast of Taiwan.

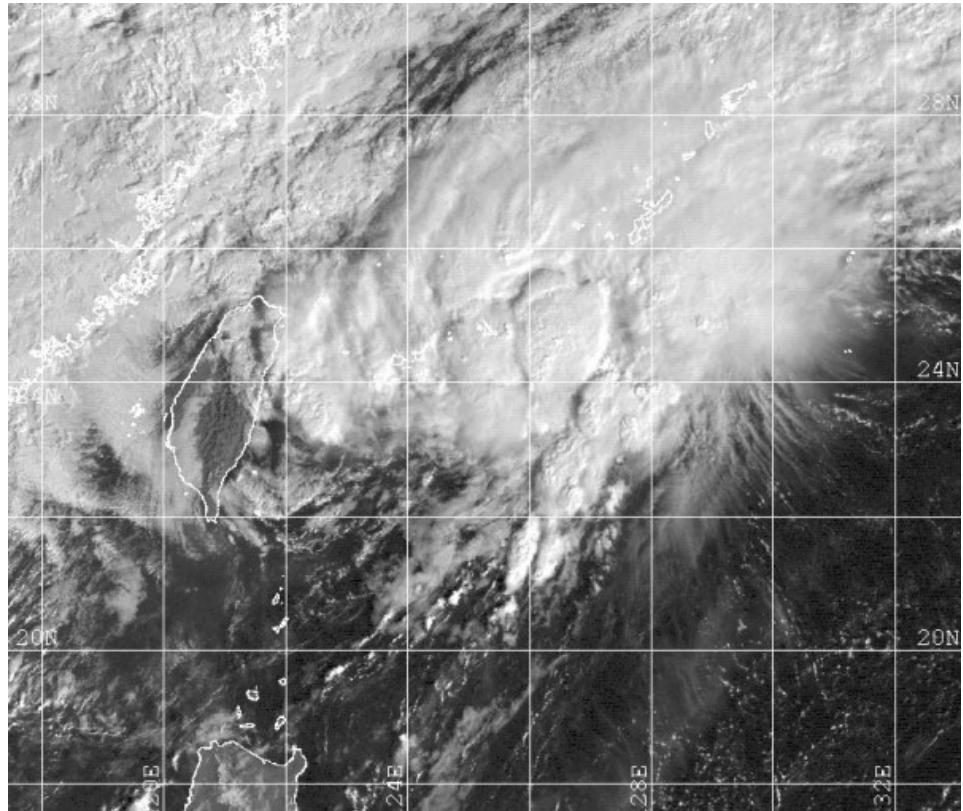


Figure 1-32W-2. 082331Z November 2000 GMS-5 visible image of TD 32W, when the cyclone was located about 120 nm east of Taiwan. Strong vertical shear is evident, with convection located to the northeast of the cyclone center.

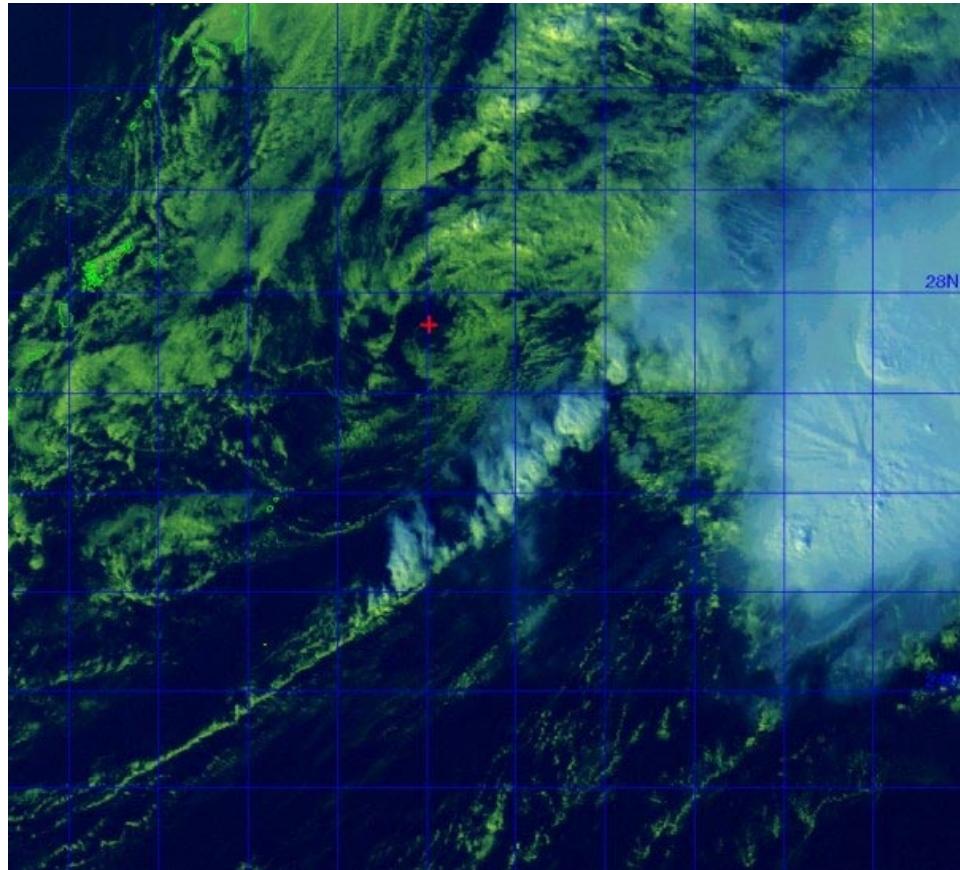
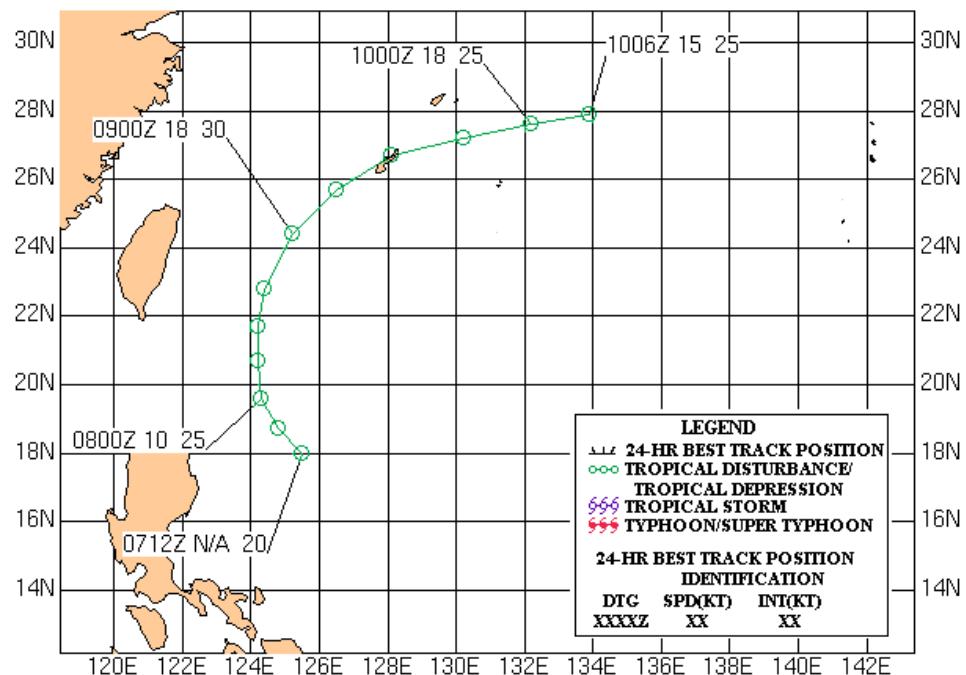


Figure 1-32W-3. 100530Z November 2000 multi-spectral image of TD 32W, located about 220 nm east-northeast of Okinawa, Japan, with a completely exposed low-level circulation.

**TROPICAL DEPRESSION 32W**  
**08 - 09 NOVEMBER 2000**



## **Typhoon (TY) 33W (Rumbia\*)**

First Poor : 0600Z 25 Nov 00

First Fair : None

First TCFA : 1900Z 27 Nov 00

First Warning : 0000Z 28 Nov 00

Last Warning : 0000Z 08 Dec 00

Max Intensity : 50 kts, Gusts to 65 kts

Landfall : 1800Z 30 Nov 00 over central Philippines

Total Warnings : 36

Remarks : None

\* Name assigned by RSMC Tokyo

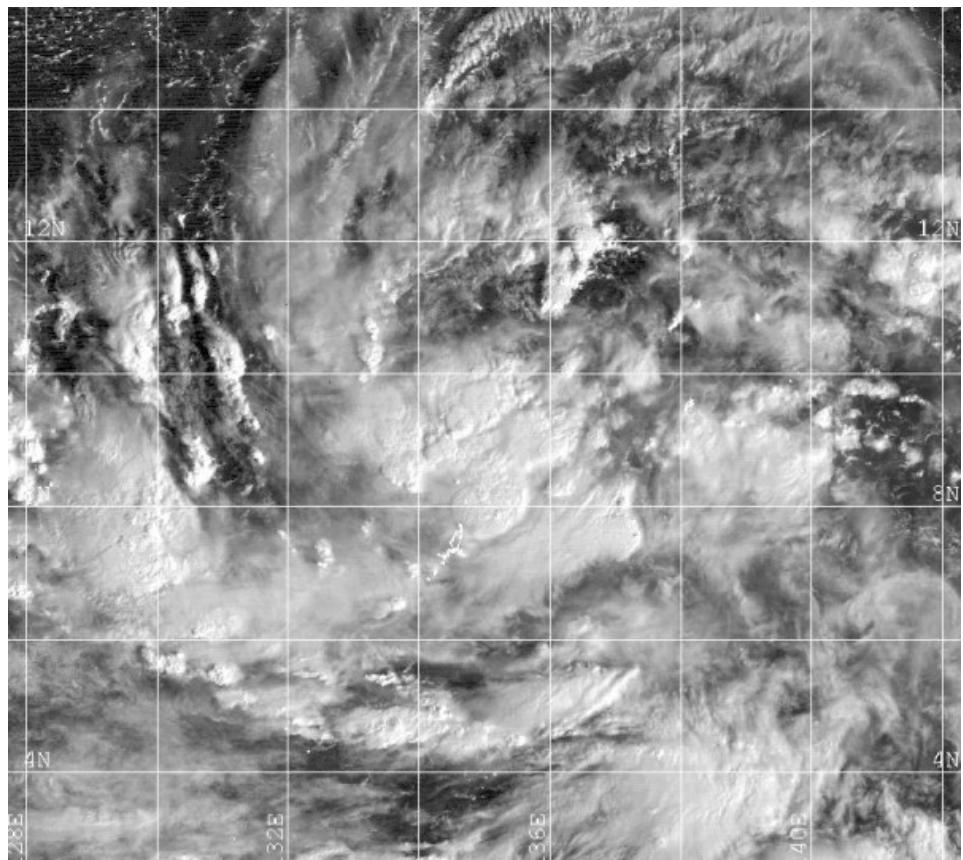


Figure 1-33W-1. 2622Z November 2000 GMS-5 visible image of the disturbance, located about 450 nm east of Mindanao Island, which became TS 33W.

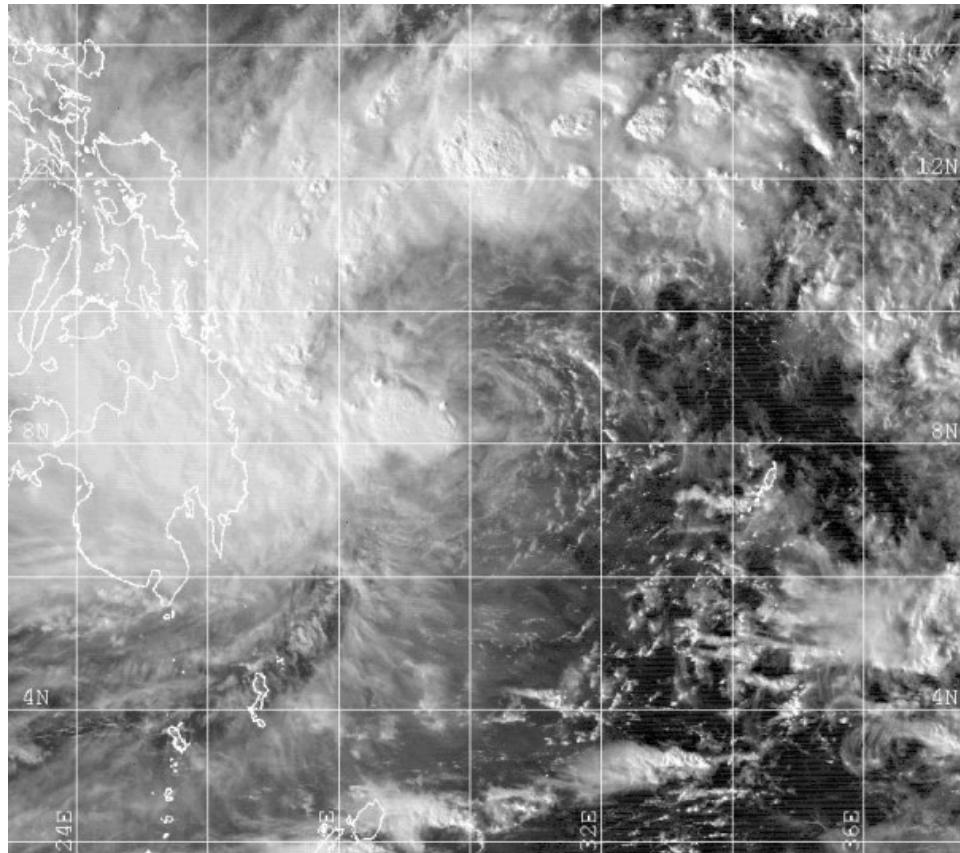


Figure 1-33W-2. 290731Z November 2000 GMS-5 visible image of TS 33W, located about 200 nm east of Mindanao Island. At this time, the convection is concentrated to the west of the cyclone center.

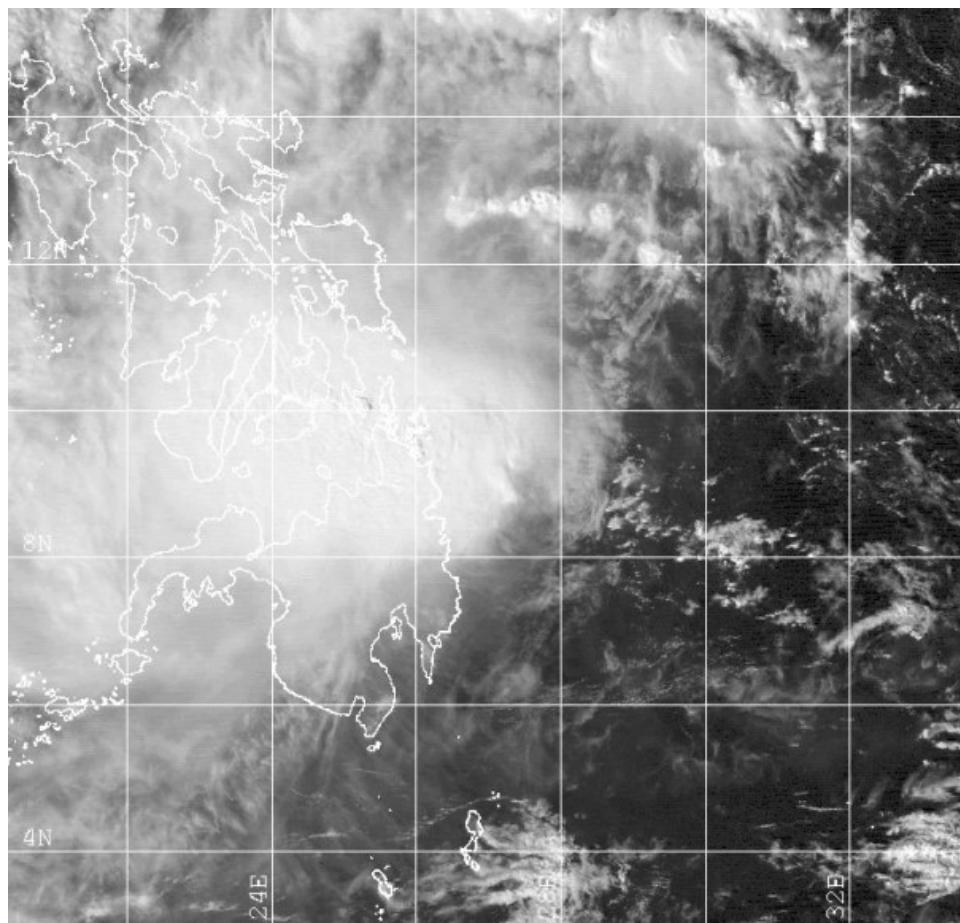
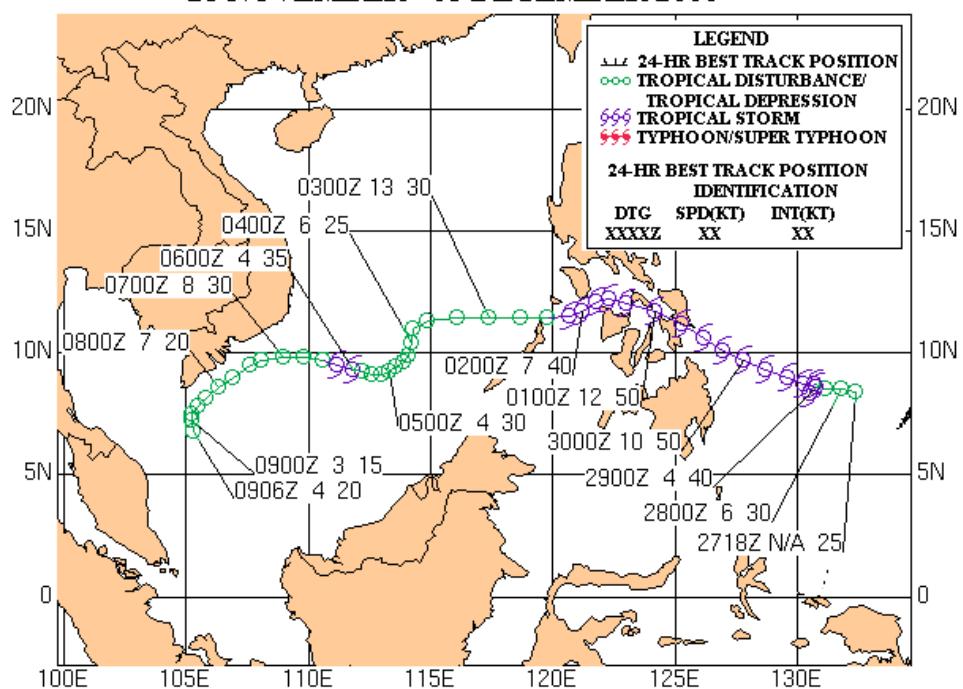


Figure 1-33W-3. 300631Z November 2000 GMS-5 visible image of TS 33W, located about 100 nm north of Mindanao Island, with the low-level circulation center located west of the deep convection.

**TROPICAL STORM 33W (RUMBIA)**  
**28 NOVEMBER - 08 DECEMBER 2000**



## **Typhoon (TY) 34W (Soulik\*)**

First Poor : 0030Z 28 Dec 00

First Fair : 0600Z 28 Dec 00

First TCFA : 1930Z 28 Dec 00

First Warning : 0000Z 29 Dec 00

Last Warning : 0000Z 05 Jan 01

Max Intensity : 110 kts, Gusts to 135 kts

Landfall : None

Total Warnings : 29

Remarks:

- (1) Rapidly intensified from 45 knots to 115 knots in 18 hours
- (2) Rapidly weakened from a peak 115 knots to 55 knots in 18 hours
- (3) Interacted with baroclinic zone near 0000Z 03 Jan 01. After reaching the baroclinic zone, turned anti-cyclonically and dissipated.

\* Name assigned by RSMC Tokyo

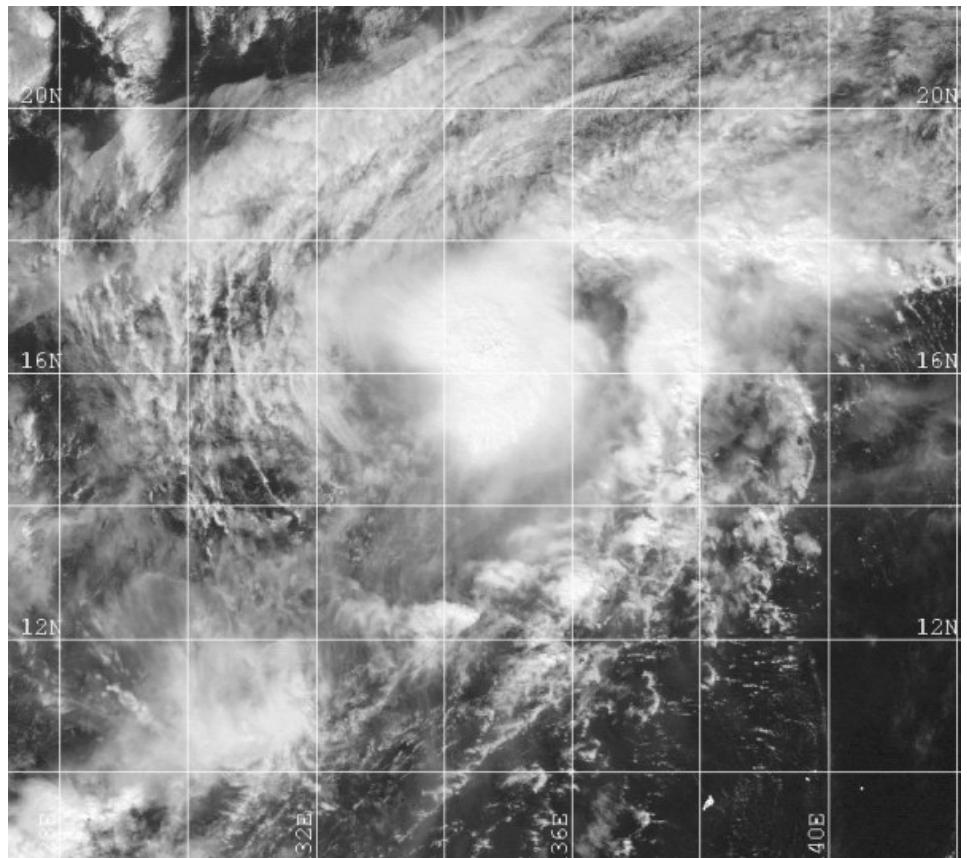


Figure 1-34W-1. 020331Z January 2001 GMS-5 visible image of TY 34W, located about 600 nm west-northwest of Agana, Guam.

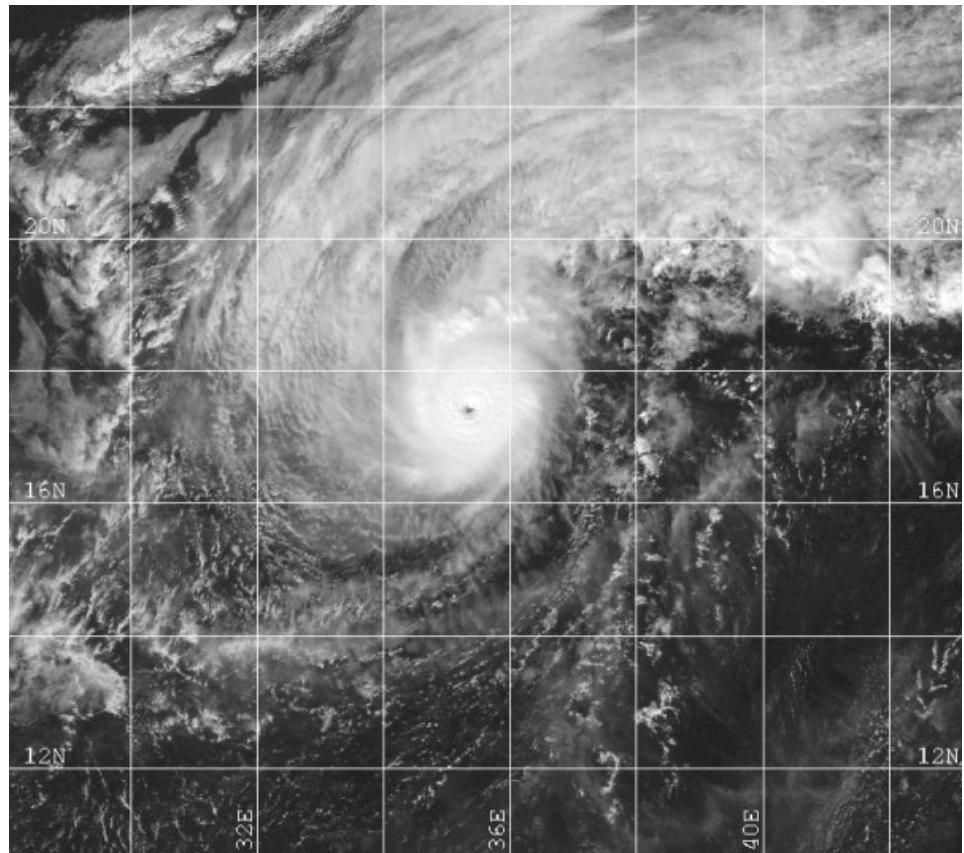


Figure 1-34W-2. 030401Z January 2001 GMS-5 visible image of TY 34W, located about 570 nm south of Iwo Jima. At this time, a tiny well-defined eye embedded in a central dense overcast is visible.

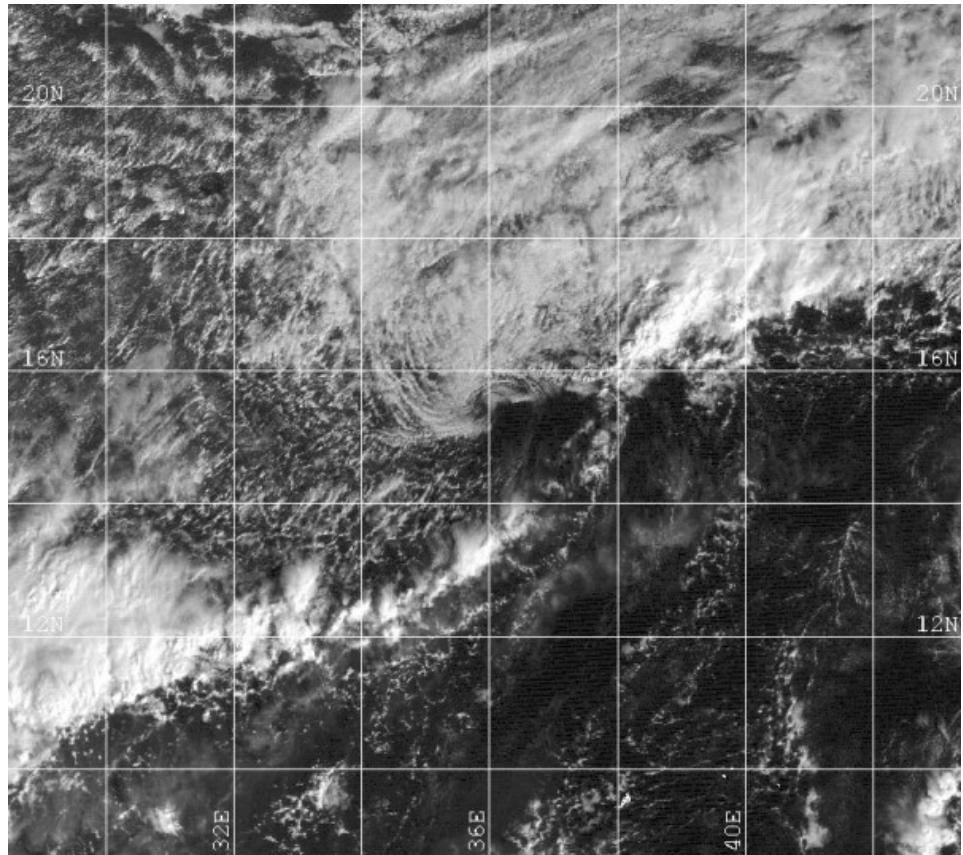
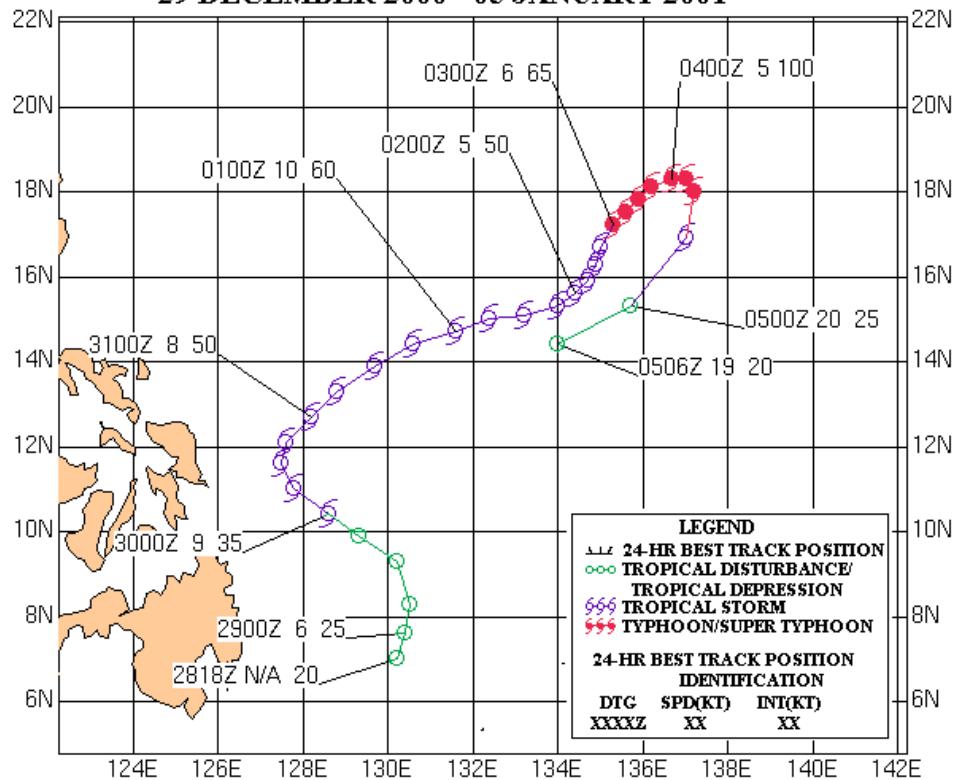


Figure 1-34W-3. 042331Z January 2001 GMS-5 visible image of TY 34W. The completely exposed low-level circulation is located in the Philippine Sea, with strong vertical shear evident in the imagery.

**TYPHOON 34W (SOULIK)**  
**29 DECEMBER 2000 - 05 JANUARY 2001**



# **Tropical Cyclone (TC) 01B**

First Poor : 1800Z 12 October 00

First Fair : 1800Z 14 October 00

First TCFA : 0630Z 15 October 00

First Warning : 0000Z 16 October 00

Last Warning : 1200Z 18 October 00

Max Intensity : 35 kts, Gusts to 45 kts

Landfall : None

Total Warnings : 6

Remarks : None

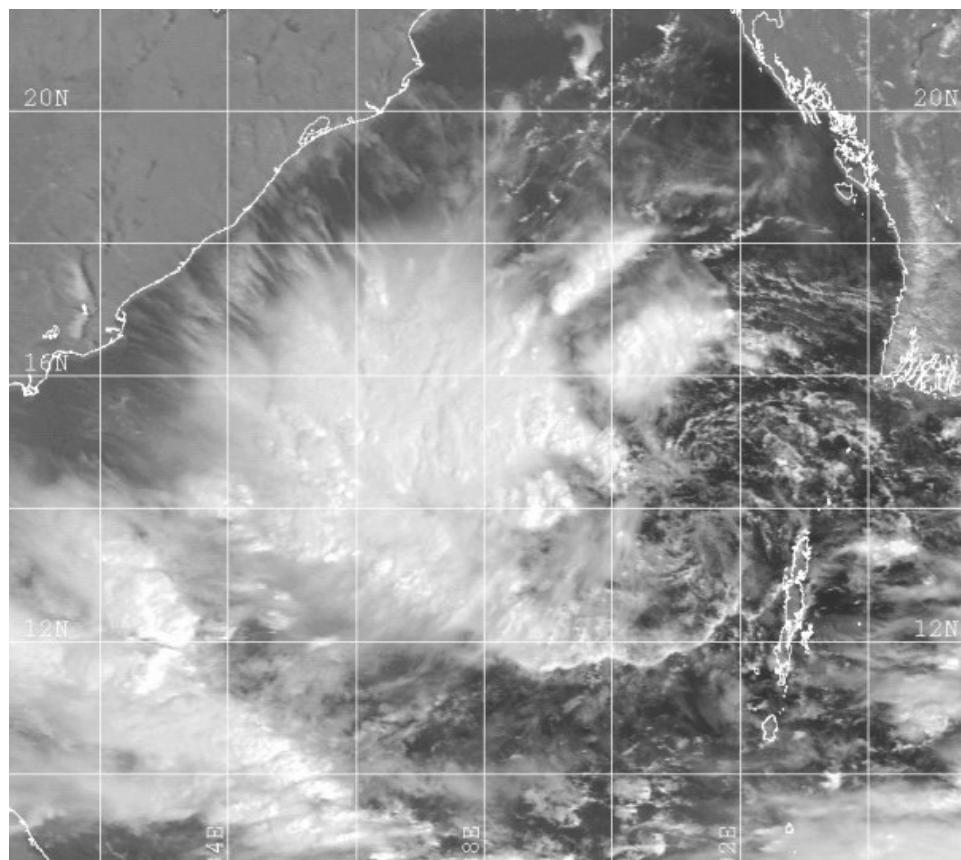


Figure 1-01B-1. 140231Z August 2000 visible image of the disturbance that became TC 01B, located about 110 nm west of the Andaman Islands with an exposed low-level circulation center.

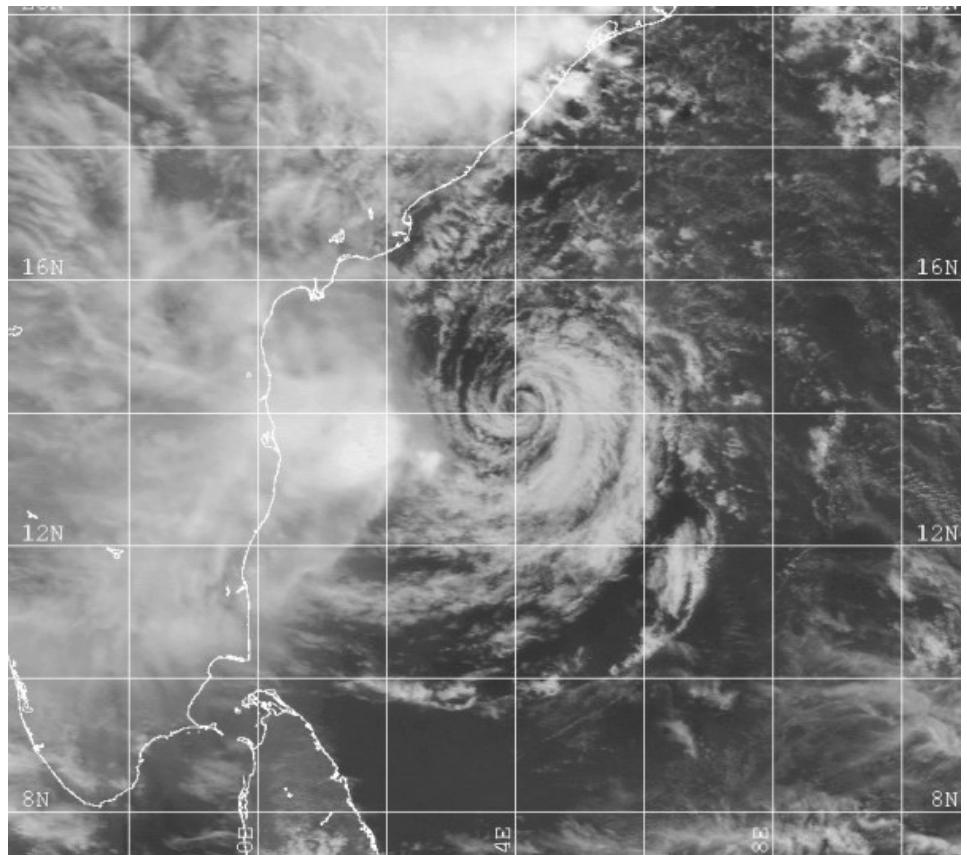


Figure 1-01B-2. 170731Z August 2000 visible image of TC 01B, located about 200 nm east of Madras, India. At this time, there is an exposed low-level circulation with little associated convection.

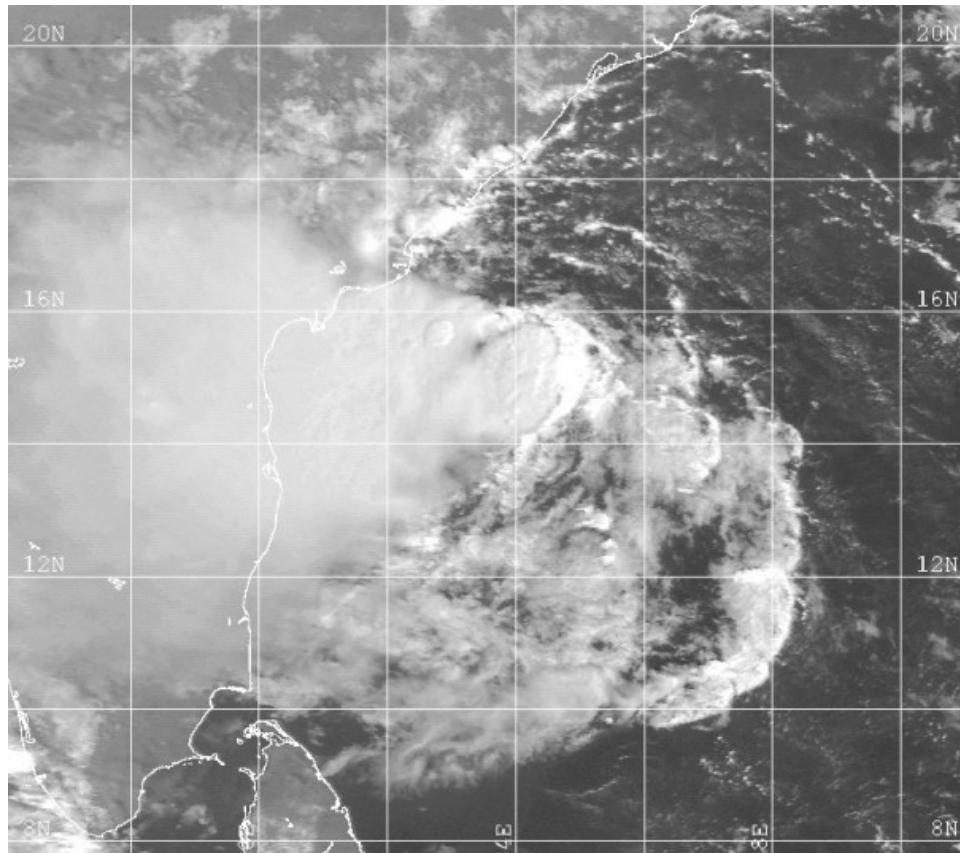
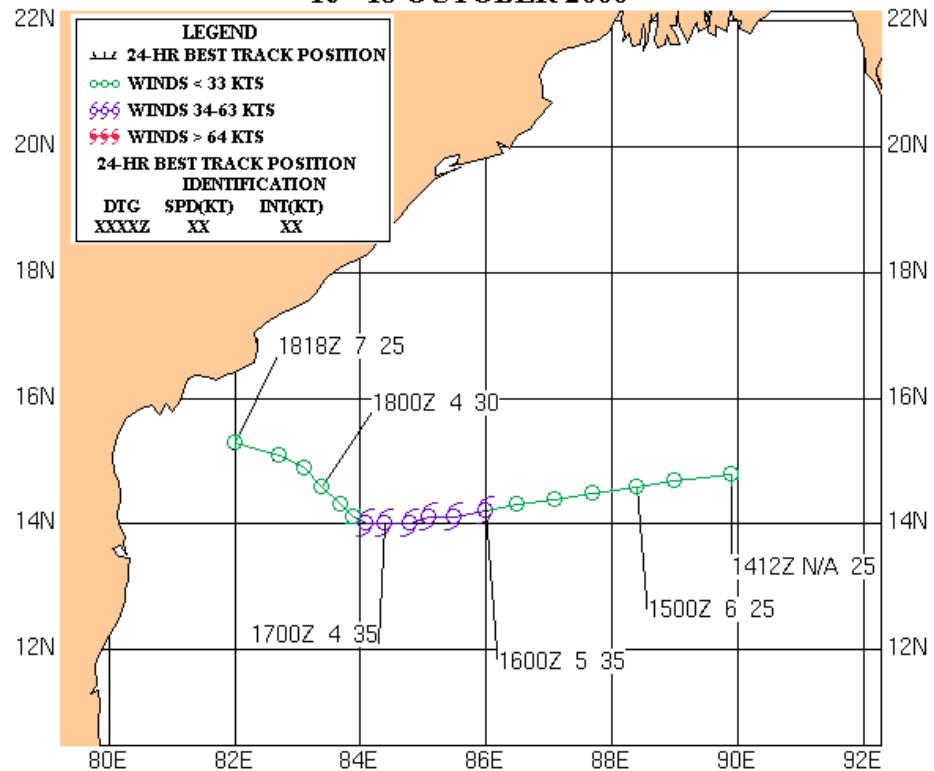


Figure 1-01B-3. 180231Z August 2000 visible image of TC 01B, located about 160 nm east-southeast of Masulipatnam, India. The very disorganized convection is displaced to the west of the circulation center.

**TROPICAL CYCLONE 01B**  
**16 - 18 OCTOBER 2000**



## **Tropical Cyclone (TC) 02B**

First Poor : 0230Z 25 October 00

First Fair : 1800Z 25 October 00

First TCFA : 1700Z 26 October 00

First Warning : 1800Z 27 October 00

Last Warning : 0600Z 28 October 00

Max Intensity : 35 kts, Gusts to 45 kts

Landfall : 0000Z 28 October 00

Total Warnings : 2

Remarks :

- (1) Twenty-five people were killed and hundreds reported missing as TC 02B made landfall southeast of Calcutta.
- (2) News agencies reported estimated winds between 45 and 55 kts and a 4 to 7 ft tidal surge as the cyclone made landfall.
- (3) Several hundred fishing boats were capsized and at least 100 mechanized fishing boats and fishermen were reported missing.

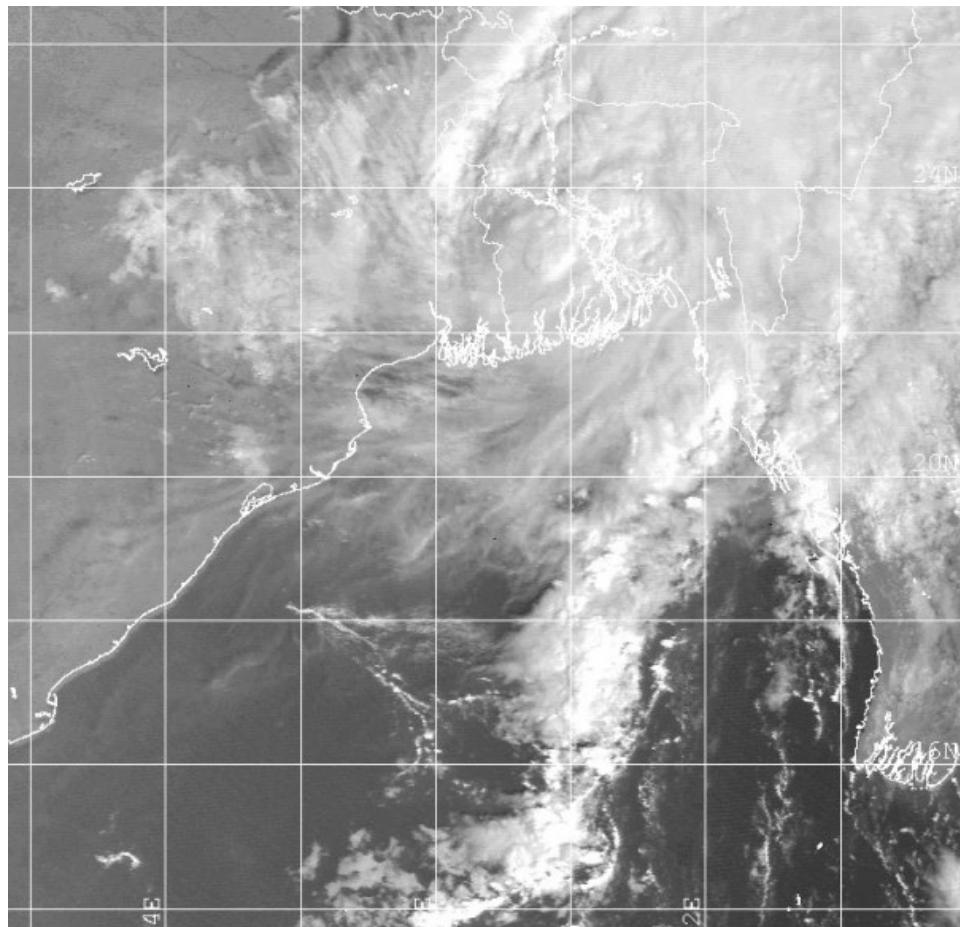
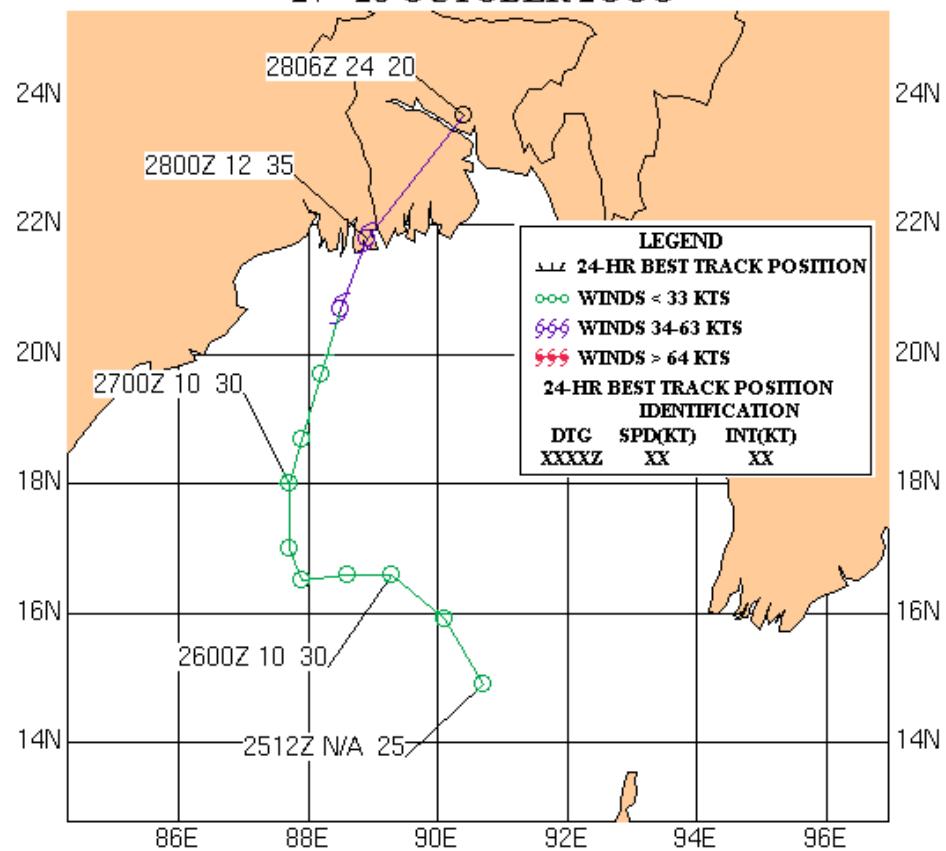


Figure 1-02B-1. 280131Z August 2000 visible image of TC 02B as it was making landfall about 45 nm southeast of Calcutta with estimated winds of 35 knots. At this time, deep convection lies to the east of the circulation center, with a trailing rainband extending southward into the Bay of Bengal.

**TROPICAL CYCLONE 02B**  
**27 - 28 OCTOBER 2000**



## **Tropical Cyclone (TC) 03B**

First Poor : 2100Z 25 Nov 00

First Fair : 0200Z 26 Nov 00

First TCFA : 0700Z 26 Nov 00

First Warning : 1200Z 26 Nov 00

Last Warning : 0600Z 05 Dec 00

Max Intensity : 75 kts, Gusts to 90 kts

Landfall : 1200Z 29 Nov 00 over southern India

Total Warnings : 16

Remarks :

- (1) TC 03B made landfall in southern Tamil Nadu, India, with estimated maximum sustained winds of 80 mph.
- (2) According to news reports, 6 people were killed.

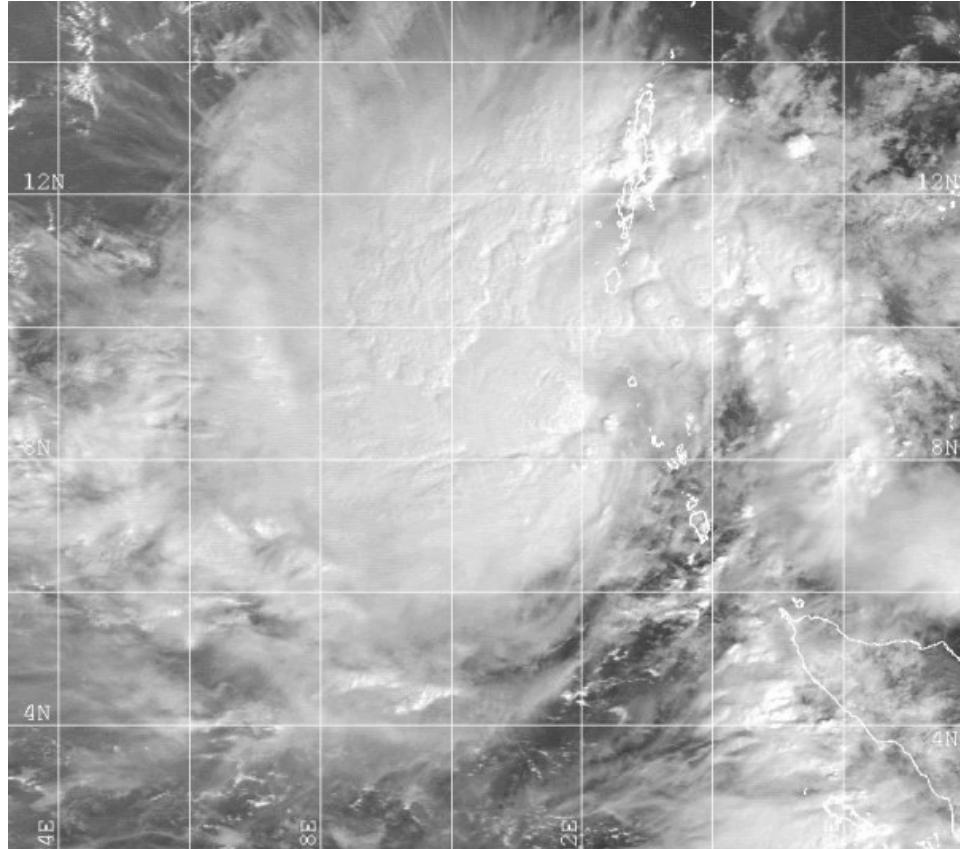


Figure 1-03B-1. 260131Z November 2000 visible image of the disturbance that became TC 03B, located south-southwest of the Andaman Islands. At this time, numerous convective elements can be seen in a broad area between 8N and 12N and 88E and 96E.

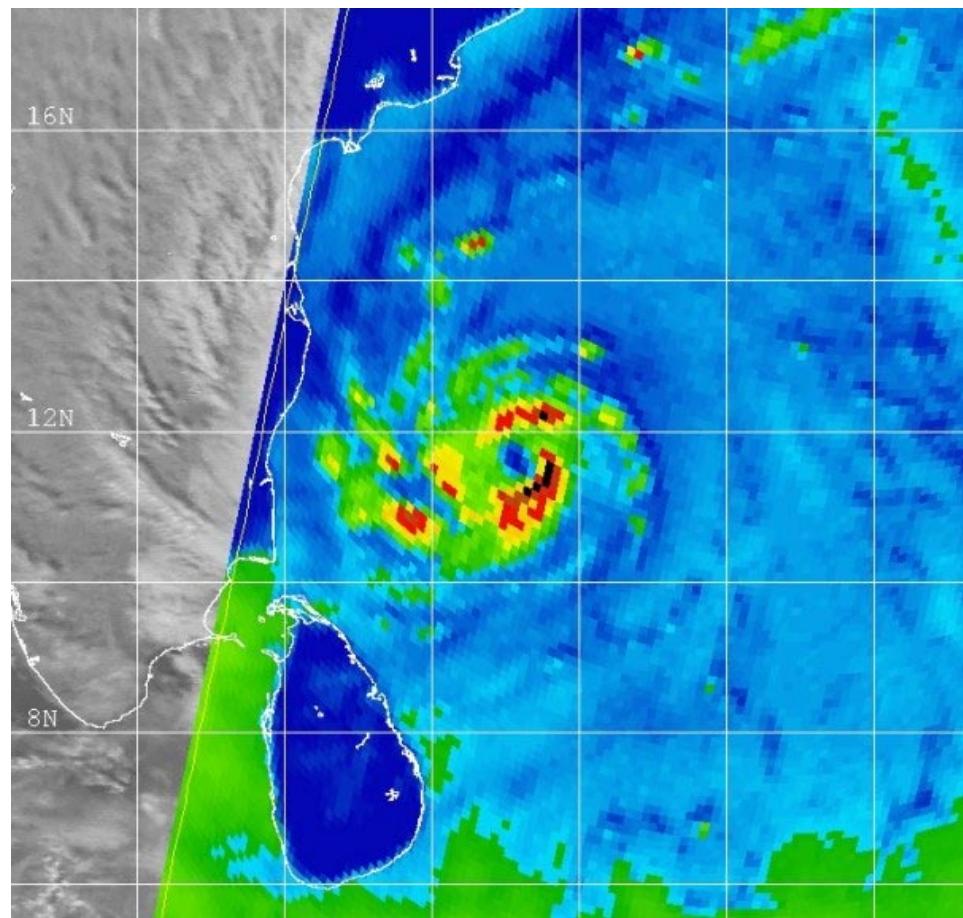


Figure 1-03B-2. 280231Z November 2000 SSMI 85GHz image of TC 03B, located about 180 nm east of Cuddalore, India with a ragged eye evident in the imagery.

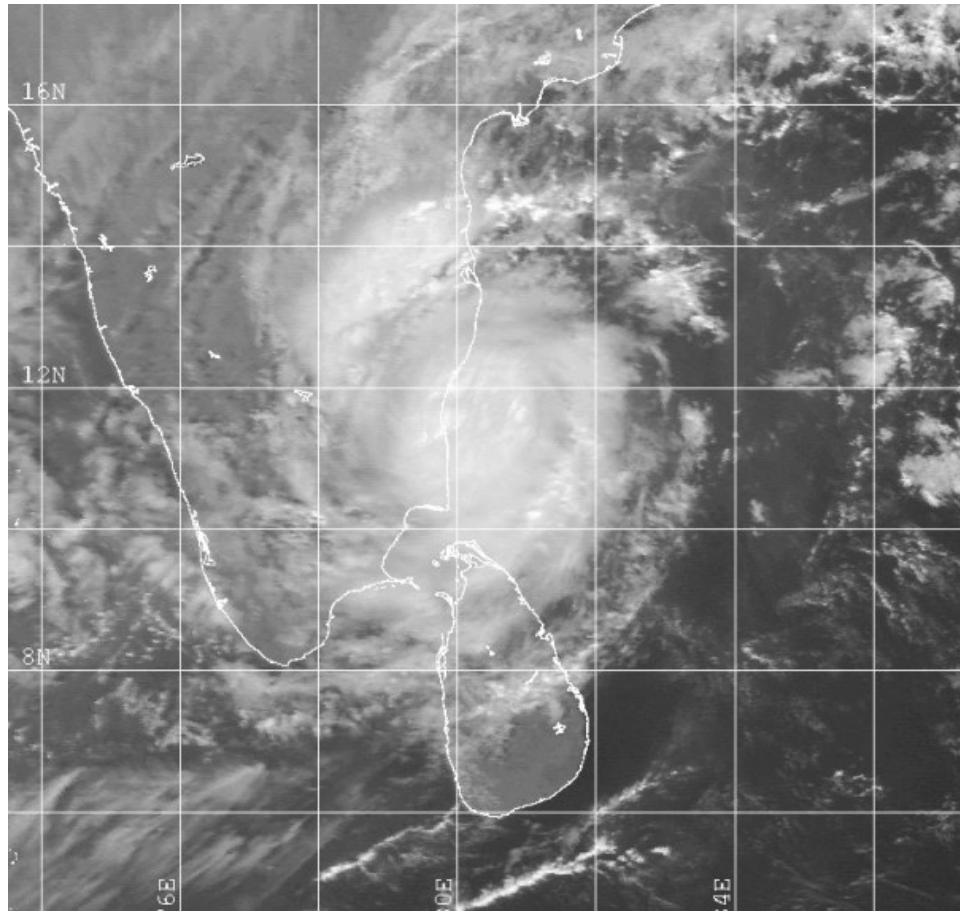


Figure 1-03B-3. 290331Z November 2000 visible image of TC 03B, located just off India. A majority of the convection is located near the center of circulation.

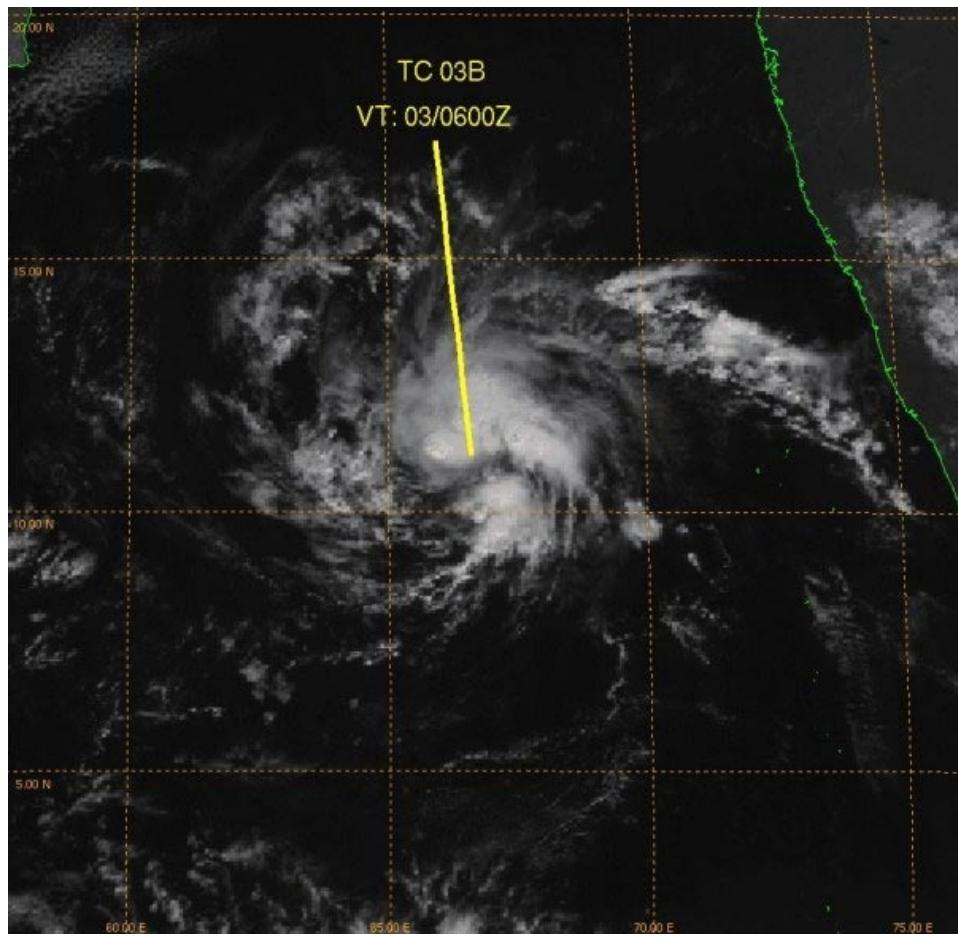
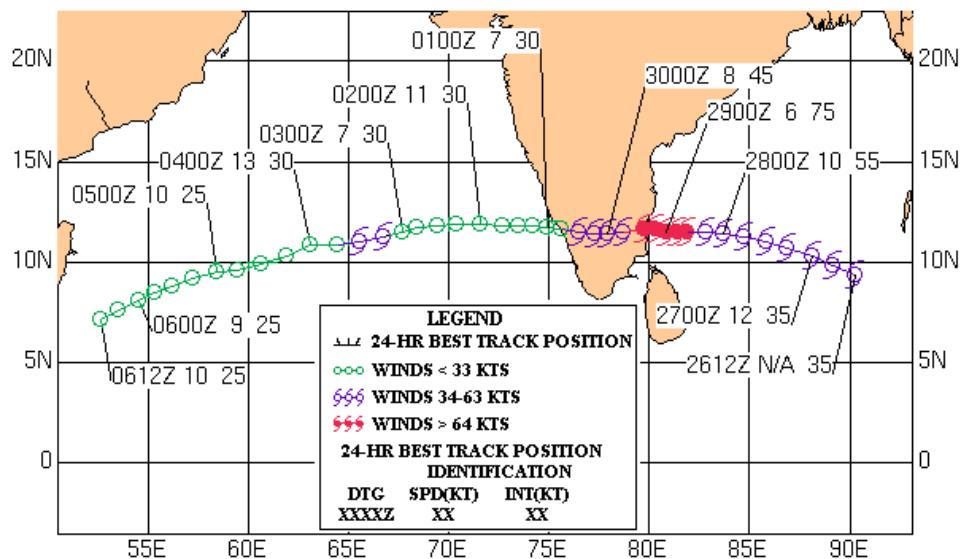


Figure 1-03B-4. 030530Z December 2000 visible image of TC 03B, located west of India in the Arabian Sea. At this time, the convection is concentrated on the northern side of the low-level circulation center, with a weak band evident on the southern side.

**TROPICAL CYCLONE 03B**  
**26 NOVEMBER - 05 DECEMBER 2000**



## **Tropical Cyclone (TC) 04B**

First Poor : 1800Z 21 Dec 00

First Fair : 0000Z 23 Dec 00

First TCFA : 0700Z 23 Dec 00

First Warning : 0600Z 25 Dec 00

Last Warning : 1800Z 28 Dec 00

Max Intensity : 60 kts, Gusts to 75 kts

Landfall : 1200Z 26 Dec 00 over Sri Lanka; 0000Z 28 Dec 00 over Southern India

Total Warnings : 8

Remarks:

(1) Five people were killed and 500,000 left homeless when TC 04B made landfall in Sri Lanka.

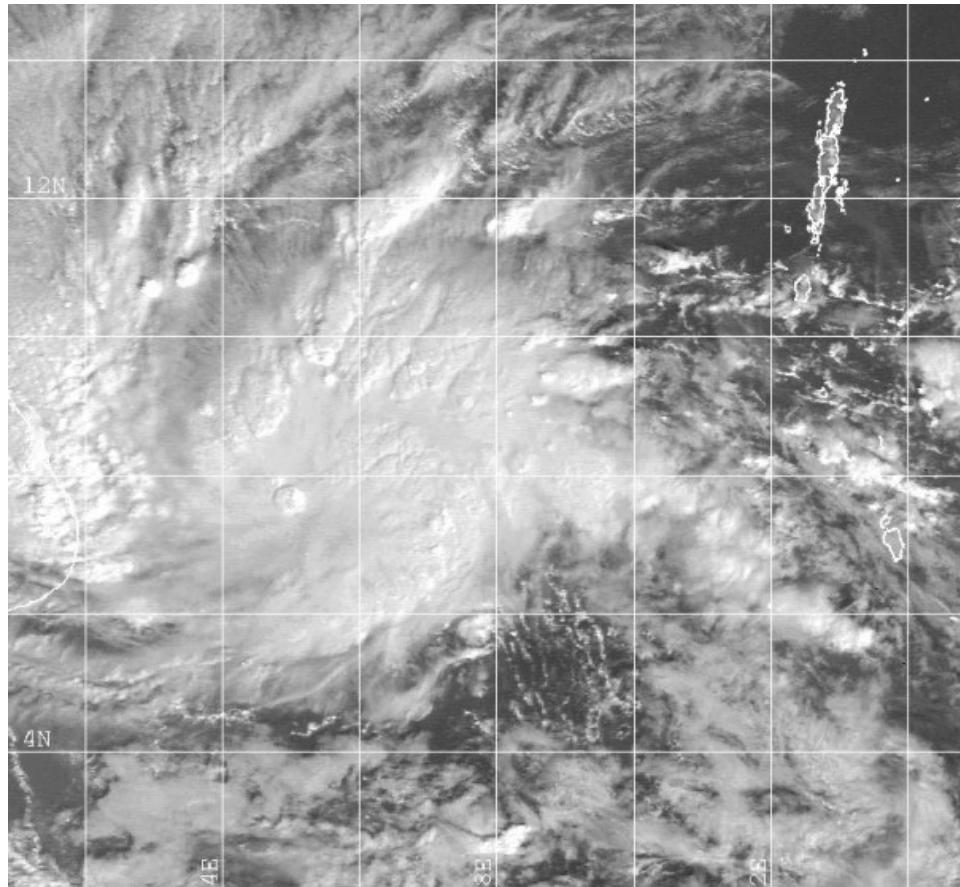


Figure 1-04B-1. 230131Z December 2000 GMS-5 visible image of TC 04B, located about 120 nm east of Sri Lanka. Note the numerous thunderstorms concentrated around the circulation center.

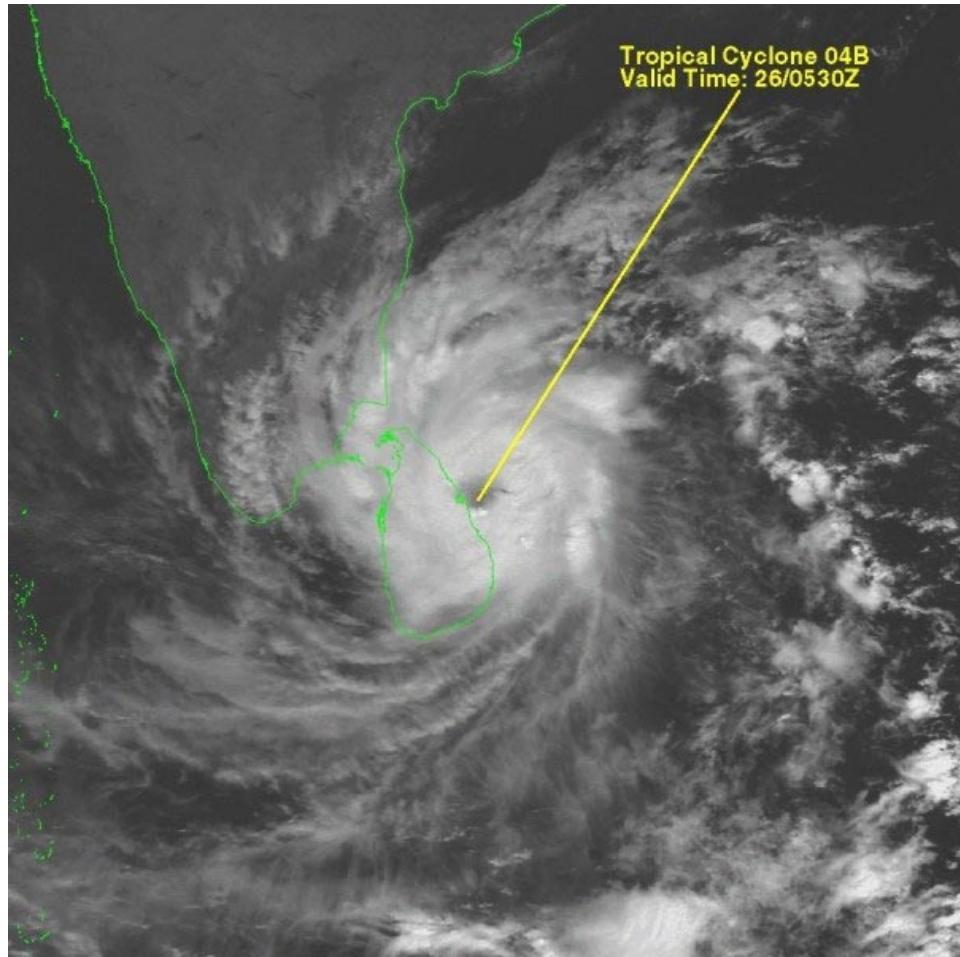
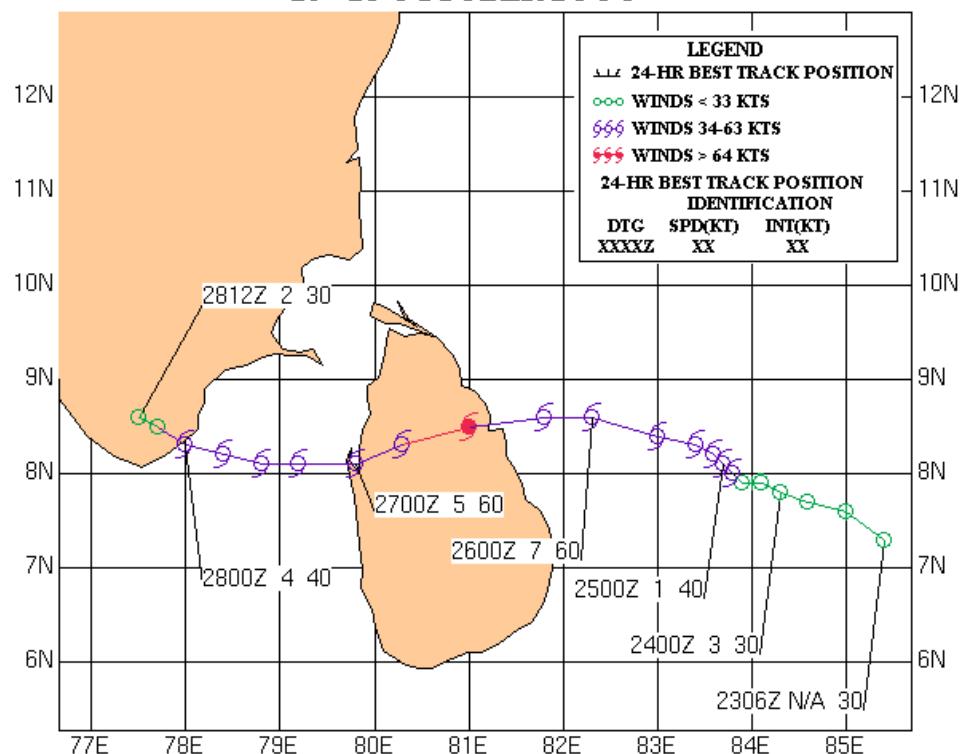


Figure 1-04B-2. 260530Z December 2000 visible image of TC 04B making landfall south of Trincomalee in eastern Sri Lanka.

**TROPICAL CYCLONE 04B**  
**23 - 28 OCTOBER 2000**



## 2. SOUTH PACIFIC AND SOUTH INDIAN OCEAN TROPICAL CYCLONES

### 2.1 GENERAL

In accordance with CINCPACINST 3140.1 (series), Southern Hemisphere tropical cyclones are numbered sequentially from 01 July through 30 June to reflect the Southern Hemisphere tropical season.

For warning message delineation, the Southern Hemisphere Area of Responsibility (AOR) is divided into two basins: the South Indian (west of 135 East longitude) and the South Pacific Ocean (east of 135 East longitude). The suffixes "S" (South Indian Ocean) and "P" (South Pacific Ocean) are appended to the tropical cyclone number to differentiate warnings for these basins. For this report, the Southern Hemisphere AOR is broken down into three sub-basins, reflecting primary cyclogenesis areas: South Indian (west of 105 East longitude), Australia (105 East longitude to 165 East longitude), and South Pacific (east of 165 East longitude).

### 2.2 SUMMARY

Table 2-1 lists the significant tropical cyclones during the 2000 season and can be compared to the climatological mean presented in Table 2-2. Table 2-3 compares this year's tropical cyclone activity in the Southern Hemisphere sub-basins to previous years and climatology. Composites of the tropical cyclone best tracks for the Southern Hemisphere appear following Table 2-3.

Table 2-1 SOUTHERN HEMISPHERE TROPICAL CYCLONES FOR 2000 (01 JULY 1999 - 30 JUNE 2000)

TC	NAME	PERIOD	NUMBER ISSUED	EST MAX SFC WINDS KTS (M/SEC)	MSLP (MB)
01S	Ilsa	10 Dec 17 Dec	18	60 (31)	980
02S	John	11 Dec 15 Dec	14	130 (67)	910
03S	Astride	25 Dec 01 Jan	16	65 (33)	976
04S	Babiola	05 Jan 12 Jan	14	90 (46)	954
05P	Iris	07 Jan 10 Jan	7	70 (36)	972
06S	-	21 Jan 23 Jan	9	30 (15)	1000
07P	Jo	24 Jan 27 Jan	7	65 (33)	976
08S	Connie	25 Jan 02 Feb	25	120 (62)	922
09S	Kirrily	27 Jan 01 Feb	12	85 (44)	958
10S	Damienne	01 Feb 02 Feb	3	50 (26)	987
11S	Leone-Eline	04 Feb 23 Feb	44	115 (59)	927
12S	Felicia	21 Feb 24 Feb	7	65 (33)	976
13P	Kim	24 Feb 29 Feb	(12)*	100 (51)	944

Table 2-1 SOUTHERN HEMISPHERE TROPICAL CYCLONES FOR 2000 (01 JULY 1999 - 30 JUNE 2000)

14P	Steve	26 Feb	10 Mar	36	65 (33)	976
15S	Gloria	28 Feb	05 Mar	21	50 (26)	987
16S	Norman	01 Mar	08 Mar	15	120 (62)	922
17S	-	01 Mar	05 Mar	9	35 (18)	997
18P	Leo	06 Mar	08 Mar	(5)*	55 (28)	984
19P	Mona	08 Mar	11 Mar	(8)*	80 (41)	963
20S	Olga	15 Mar	19 Mar	8	50 (26)	987
21S	Hudah	24 Mar	09 Apr	40	125 (64)	916
22P	Tessi	01 Apr	03 Apr	5	50 (26)	987
23P	Vaughan	03 Apr	07 Apr	9	50 (26)	987
24S	Paul	13 Apr	21 Apr	18	130 (67)	910
25P	Neil	15 Apr	17 Apr	7	40 (21)	994
26S	Innocente	15 Apr	19 Apr	8	45 (23)	991
27S	Rosita	17 Apr	20 Apr	7	125 (64)	916
JTWC TOTAL						
( )NPMOC TOTAL						
GRAND TOTAL						

\*WARNINGS ISSUED BY NPMOC

Table 2-2 DISTRIBUTION OF SOUTH PACIFIC AND SOUTH INDIAN OCEAN TROPICAL CYCLONES FOR 1958 - 2000

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTALS
1958- 1977 AVE*	-	-	-	0.4	1.5	3.6	6.1	5.8	4.7	2.1	0.5	-	24.7
1981	0	0	0	1	3	2	6	5	3	3	1	0	24
1982	1	0	0	1	1	3	9	4	2	3	1	0	25
1983	1	0	0	1	1	3	5	6	3	5	0	0	25
1984	1	0	0	1	2	5	5	10	4	2	0	0	30
1985	0	0	0	0	1	7	9	9	6	3	0	0	35
1986	0	0	1	0	1	1	9	9	6	4	2	0	33
1987	0	1	0	0	1	3	6	8	3	4	1	1	28
1988	0	0	0	0	2	3	5	5	3	1	2	0	21
1989	0	0	0	0	2	1	5	8	6	4	2	0	28
1990	2	0	1	1	2	2	4	4	10	2	1	0	29
1991	0	0	1	1	1	3	2	5	5	2	1	1	22
1992	0	0	1	1	2	5	4	11	3	2	1	0	30
1993	0	0	1	1	0	5	7	7	2	2	2	0	27
1994	0	0	0	0	2	4	8	4	9	3	0	0	30
1995	0	0	0	0	2	2	5	4	5	4	0	0	22
1996	0	0	0	0	1	3	7	6	6	4	1	0	28
1997	1	1	1	2	2	6	9	8	3	1	3	1	38
1998	1	0	0	3	2	3	7	9	6	6	0	0	37
1999	1	0	1	1	1	6	6	8	7	2	0	0	33

Table 2-2 DISTRIBUTION OF SOUTH PACIFIC AND SOUTH INDIAN OCEAN TROPICAL CYCLONES FOR 1958 - 2000

2000	0	0	0	0	0	3	6	5	7	6	0	0	27
(1981-2000)													
MEAN	0.4	0.1	0.4	0.7	1.5	3.5	6.2	6.8	5.0	3.2	0.9	0.2	28.6
CASES	8	2	7	14	29	70	124	135	99	63	18	3	572

\* (GRAY, 1978)

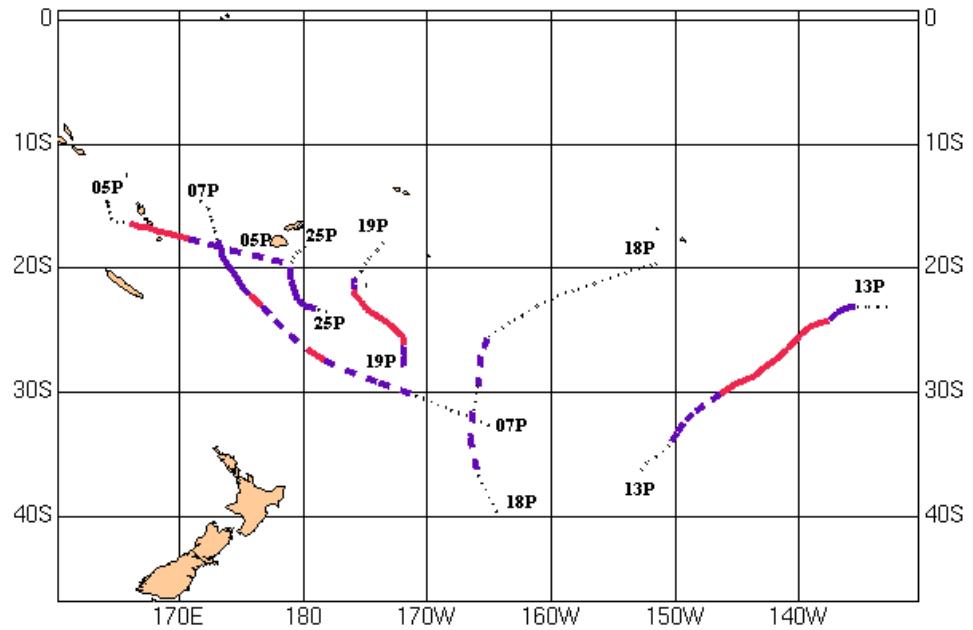
The criteria used in TABLE 2-2 are as follows:

- 1) If a tropical cyclone was first warned on during the last two days of a particular month and continued into the next month for longer than two days, then that system was attributed to the second month.
- 2) If a tropical cyclone was warned on prior to the last two days of a month, it was attributed to the first month, regardless of how long the system lasted.
- 3) If a tropical cyclone began on the last day of the month and ended on the first day of the next month, that system was attributed to the first month. However, if a tropical cyclone began on the last day of the month and continued into the next month for only two days, then it was attributed to the second month.

Table 2-3 ANNUAL VARIATION OF SOUTHERN HEMISPHERE TROPICAL CYCLONE BY OCEAN BASIN

YEAR	SOUTH IN-	AUSTRALIAN	SOUTH	TOTAL	
	DIAN	(WEST OF 105E)	(105E - 165E)	PACIFIC	
1958-1977 AVER- AGE*	8.4		10.3	5.9	24.6
1981	13		8	3	24
1982	12		11	2	25
1983	7		6	12	25
1984	14		14	2	30
1985	14		15	6	35
1986	14		16	3	33
1987	9		8	11	28
1988	14		2	5	21
1989	12		9	7	28
1990	18		8	3	29
1991	11		10	1	22
1992	11		6	13	30
1993	10		16	1	27
1994	16		10	4	30
1995	11		7	4	22
1996	13		11	4	28
1997	17		5	16	38
1998	12		10	15	37
1999	13		16	4	33
2000	10		12	5	27
(1981-2000)					
TOTAL	251		200	121	572
AVERAGE	12.6		10.0	6.1	28.6

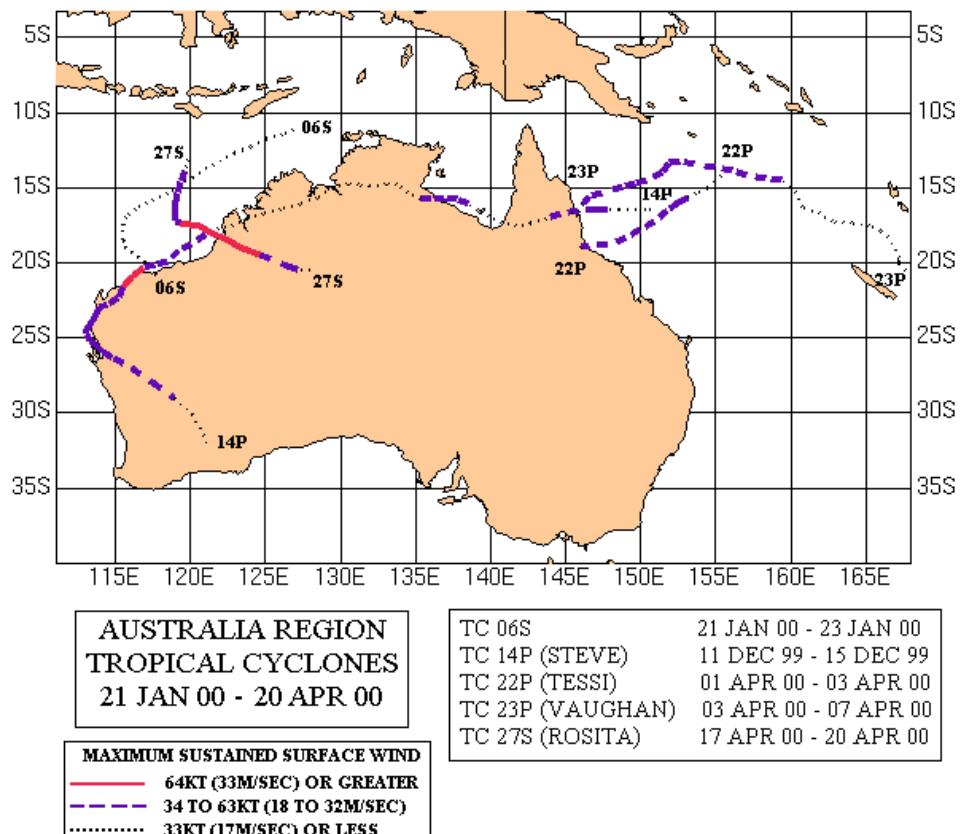
\* (Gray, 1978)

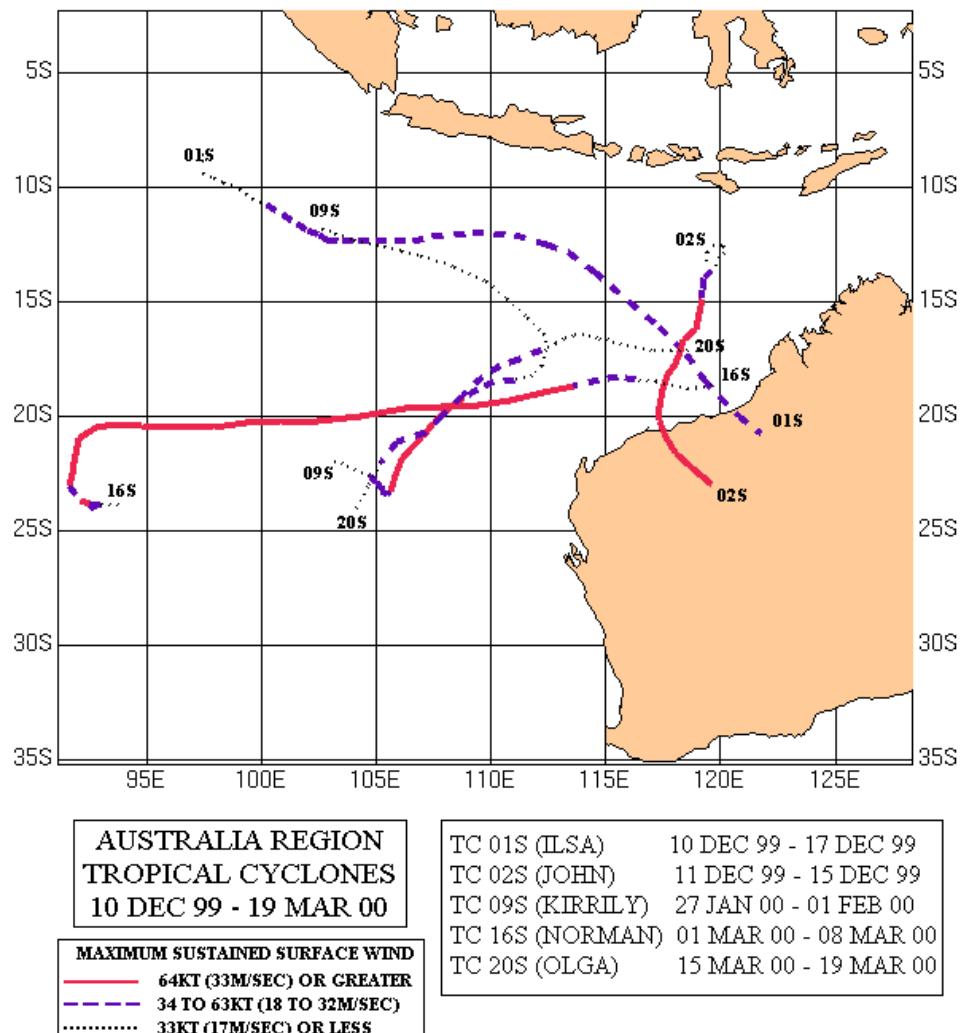


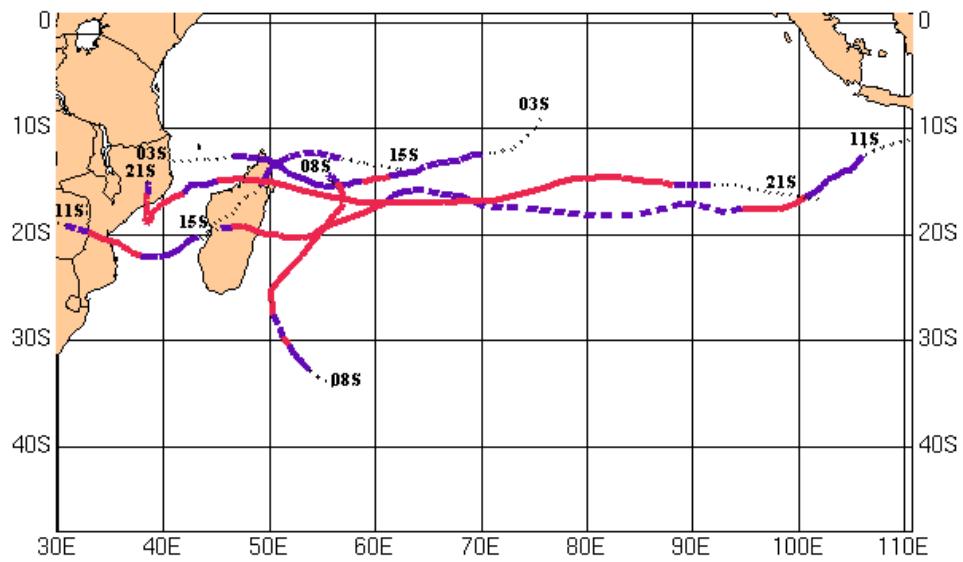
**SOUTH PACIFIC OCEAN  
TROPICAL CYCLONES  
07 JAN 00 - 21 APR 00**

**MAXIMUM SUSTAINED SURFACE WIND**  
 ————— 64KT (33M/SEC) OR GREATER  
 - - - - - 34 TO 63KT (18 TO 32M/SEC)  
 ..... 33KT (17M/SEC) OR LESS

TC 05P (IRIS)	07 JAN 00 - 10 JAN 00
TC 07P (JO)	24 JAN 00 - 27 JAN 00
TC 13P (KIM)	24 FEB 00 - 29 FEB 00
TC 18P (LEO)	06 MAR 00 - 08 MAR 00
TC 19P (MONA)	08 MAR 00 - 11 MAR 00
TC 25P (NEIL)	15 APR 00 - 17 APR 00





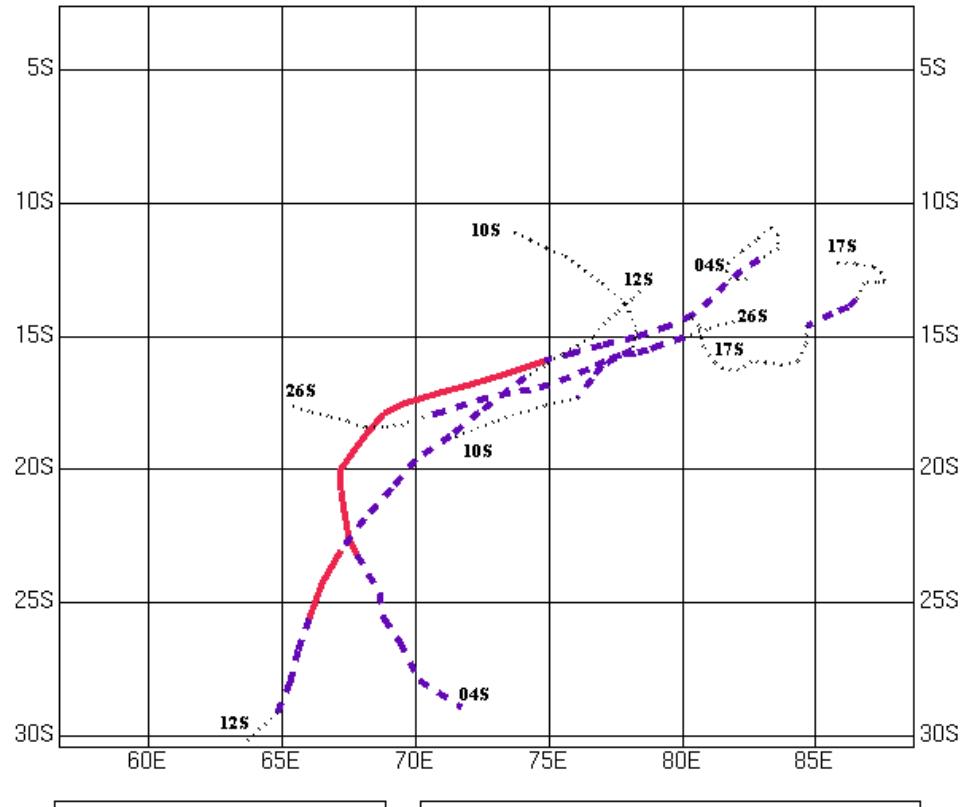


**SOUTH INDIAN OCEAN  
TROPICAL CYCLONES  
25 DEC 99 - 17 APR 00**

TC 03S (ASTRIDE)	25 DEC 99 - 01 JAN 00
TC 08S (CONNIE)	25 JAN 00 - 02 FEB 00
TC 11S (LEON-ELINE)	04 FEB 00 - 23 FEB 00
TC 15S (GLORIA)	28 FEB 00 - 05 MAR 00
TC 21S (HUDAH)	24 MAR 00 - 09 APR 00

**MAXIMUM SUSTAINED SURFACE WIND**

—	64KT (33M/SEC) OR GREATER
- - -	34 TO 63KT (18 TO 32M/SEC)
.....	33KT (17M/SEC) OR LESS



SOUTH INDIAN OCEAN  
TROPICAL CYCLONES  
05 JAN 00 - 19 APR 00

TC 04S (BABIOLA)	05 JAN 00 - 12 JAN 00
TC 10S (DAMIENNE)	01 FEB 00 - 02 FEB 00
TC 12S (FELICIA)	21 FEB 00 - 24 FEB 00
TC 17S	01 MAR 00 - 08 MAR 00
TC 26S (INNOCENTE)	15 APR 00 - 19 APR 00

MAXIMUM SUSTAINED SURFACE WIND  
 ————— 64KT (33M/SEC) OR GREATER  
 - - - - 34 TO 63KT (18 TO 32M/SEC)  
 ..... 33KT (17M/SEC) OR LESS

# **Tropical Cyclone (TC) 01S (Ilsa\*)**

First Poor : None

First Fair : 0830Z 10 Dec 99

First TCFA : 1630Z 10 Dec 99

First Warning : 1800Z 11 Dec 99

Last Warning : 1200Z 15 Dec 99

Max Intensity : 60 kts, Gusts to 75 kts

Landfall : 0430Z 17 Dec 99

Total Warnings : 18

Remarks : None

\* Name assigned by Perth TCWC

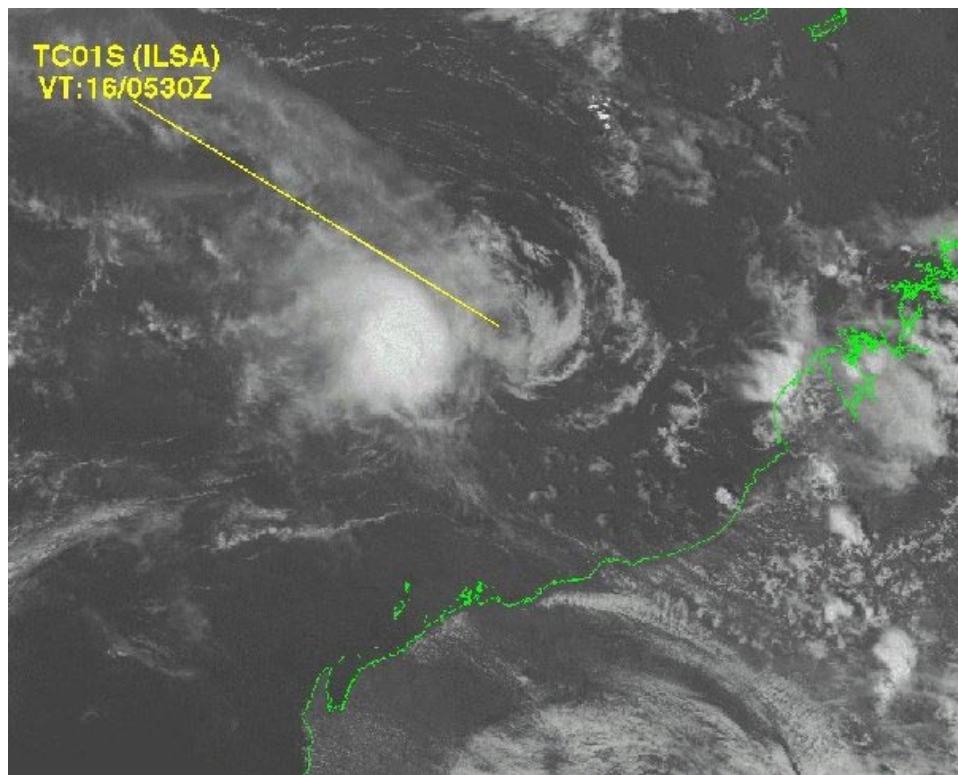
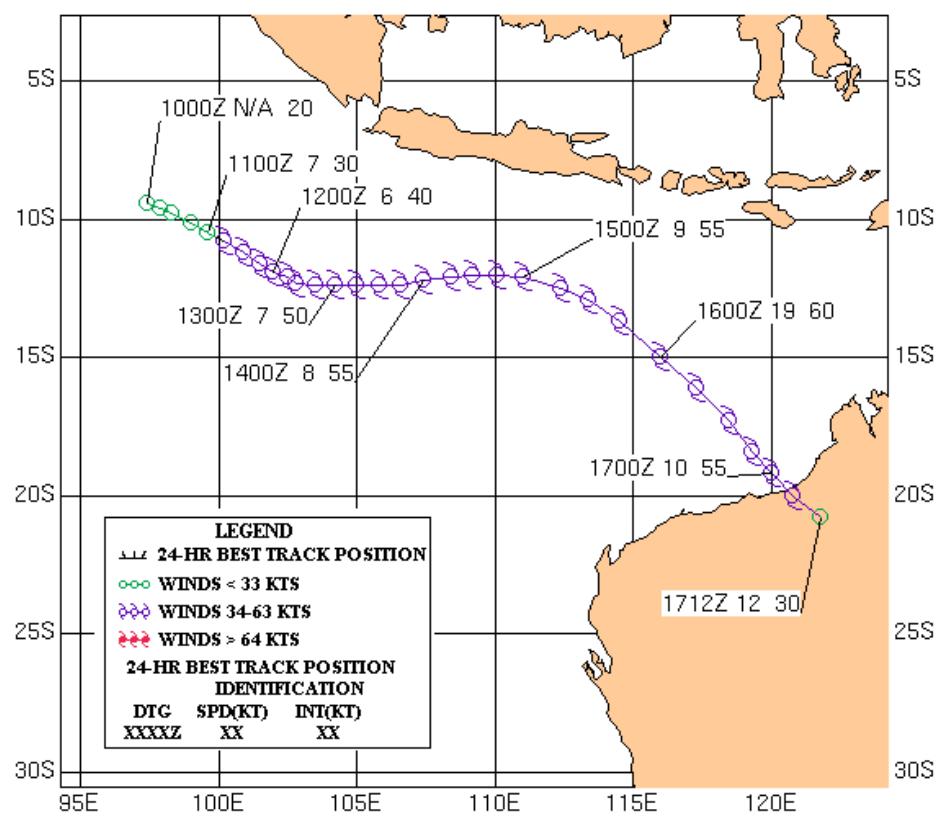


Figure 2-01S-1. 160530Z December 1999 visible satellite imagery of TC 01S, located west of the Kimberly region of Western Australia. At this time, the low-level circulation center is completely exposed, with the convection displaced approximately 70 nm to the west-southwest.

TROPICAL CYCLONE 01S (ILSA)  
10 - 17 DECEMBER 1999



## **Tropical Cyclone (TC) 02S (John\*)**

First Poor : 1800Z 07 Dec 99

First Fair : 1800Z 09 Dec 99

First TCFA : 0500Z 10 Dec 99

First Warning : 1800Z 11 Dec 99

Last Warning : 1200Z 15 Dec 99

Max Intensity : 130 kts, Gusts to 160 kts

Landfall : 2200Z 14 Dec 99

Total Warnings : 14

Remarks : None

\* Name assigned by Perth TCWC

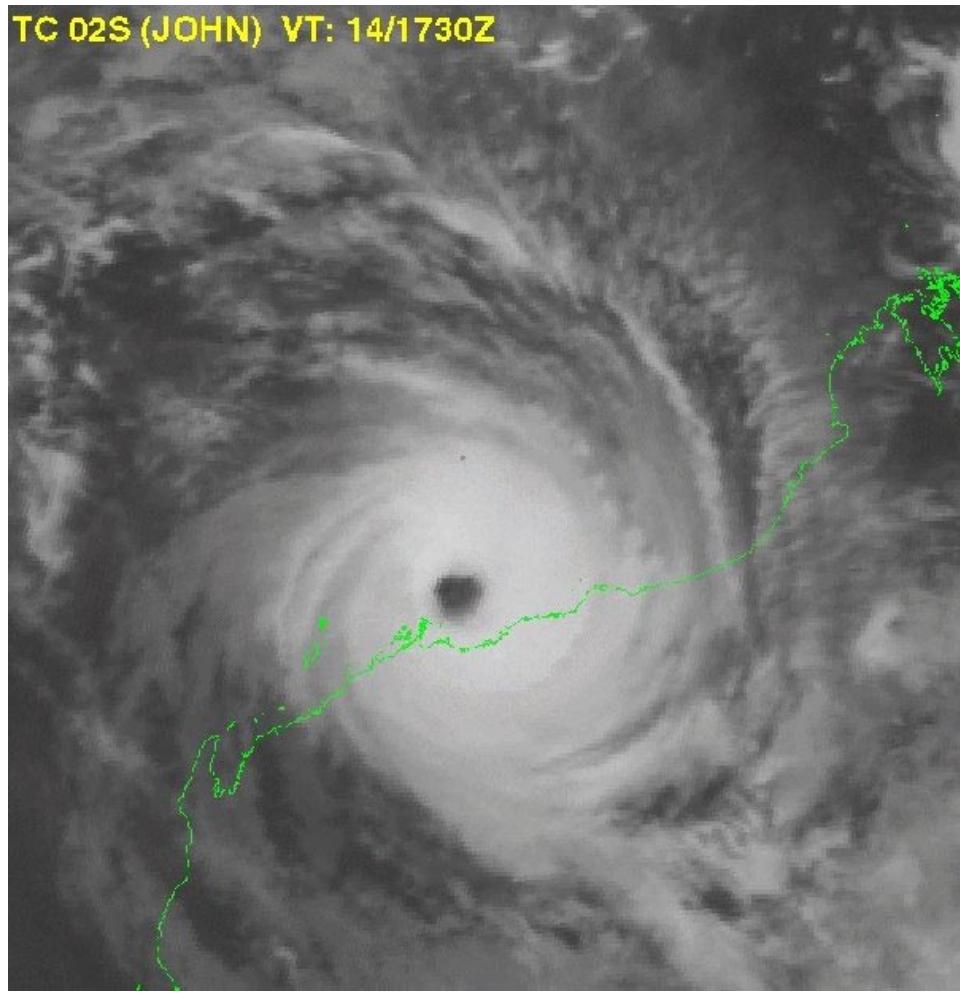


Figure 2-02S-1. 141730Z December 1999 infrared satellite imagery of TC 02S, located just north of Whim Creek, Australia with a cloud free 33 nm diameter eye.

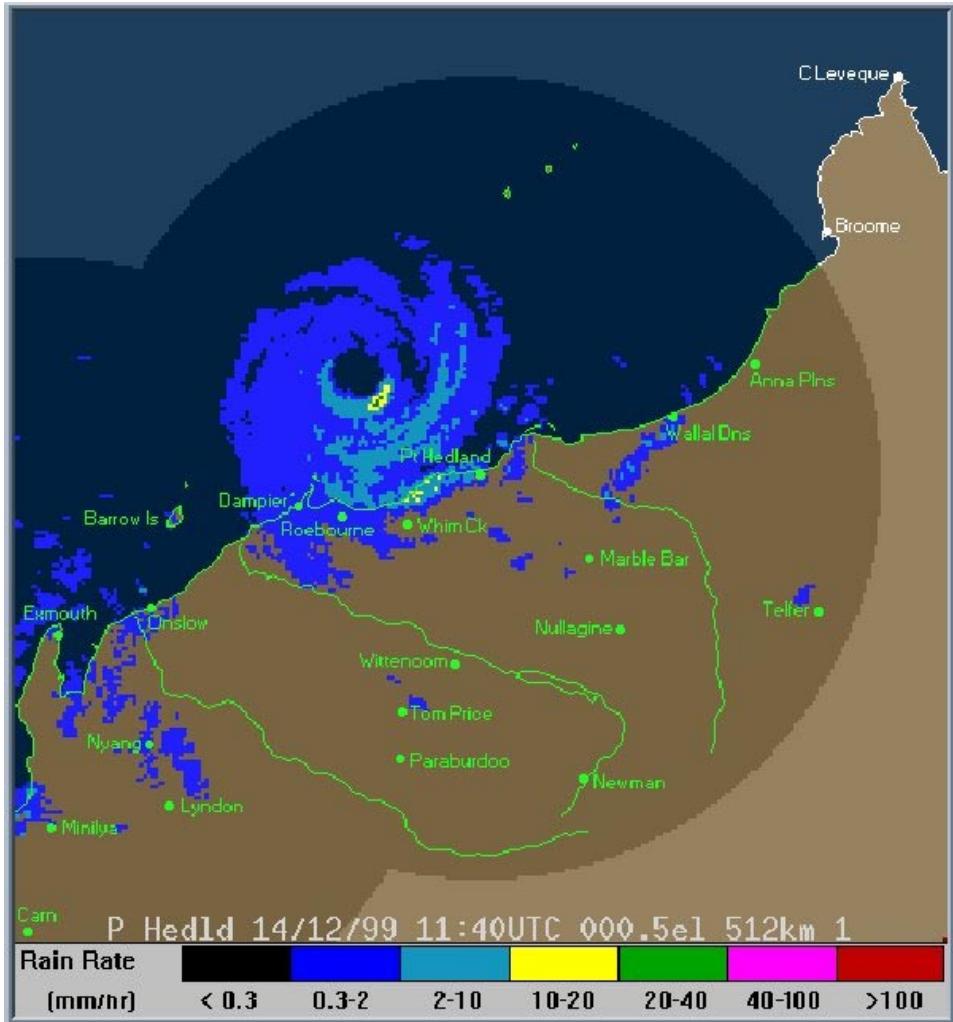
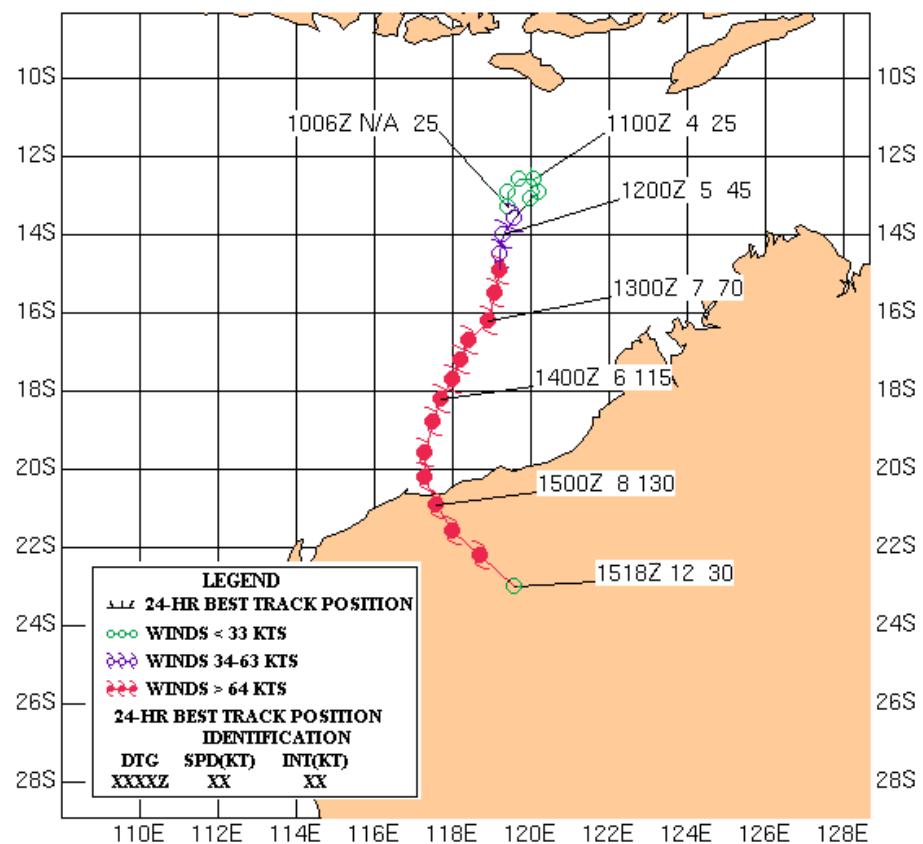


Figure 2-02S-2. 141140Z December 1999 0.5 degree elevation angle radar image of TC 02S from Port Hedland, Australia. At this time, an extensive area of rain, including rain bands to the southeast and southwest, was evident, with the heaviest regions of rain located south and southeast of the eye.

TROPICAL CYCLONE 02S (JOHN)  
11 - 15 DECEMBER 2000



## **Tropical Cyclone (TC) 03S (Astride\*)**

First Poor : 1800Z 22 Dec 99

First Fair : 1800Z 23 Dec 99

First TCFA : 0230Z 24 Dec 99

First Warning : 0000Z 25 Dec 99

Last Warning : 0000Z 01 Jan 00

Max Intensity : 65 kts, Gusts to 90 kts

Landfall : 1800Z 31 Dec 99 over northern Madagascar; 0000Z 03 Jan 00 as it dissipated over Mozambique

Total Warnings : 16

Remarks : None

\* Name assigned by RSMC La Reunion

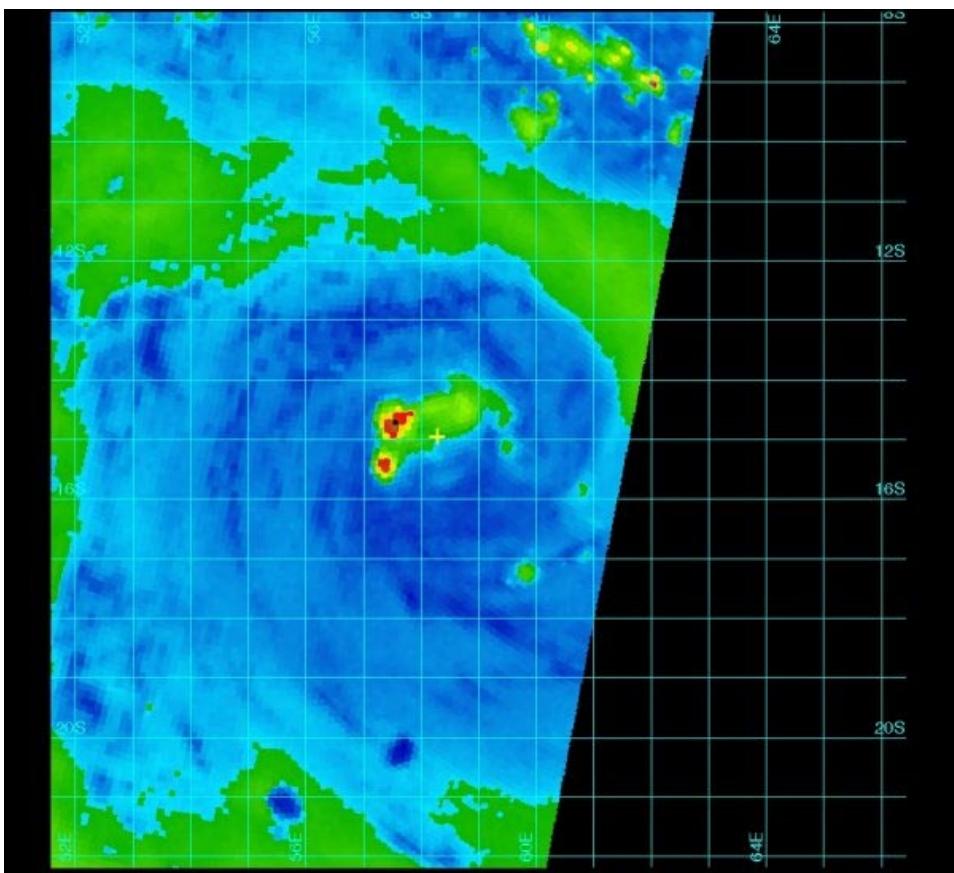
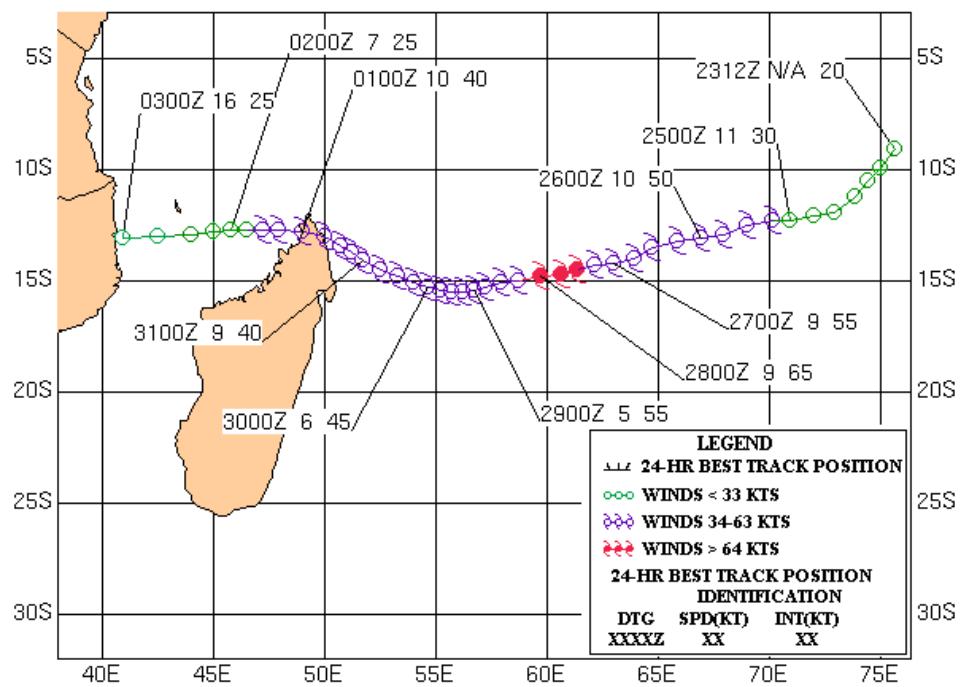


Figure 2-03S-1. 280445Z December 1999 SSMI 85 GHz of TC 03S, located north of Mauritius and La Reunion, with a partially exposed low-level circulation center and deep convection confined primarily to the northern half of the system.

TROPICAL CYCLONE 03S (ASTRIDE)  
25 DECEMBER 1999 - 01 JANUARY 2000



# Tropical Cyclone (TC) 04S (Babiola\*)

First Poor : 1000Z 01 Jan 00

First Fair : 0730Z 03 Jan 00

First TCFA : 1630Z 03 Jan 00

First Warning : 1800Z 05 Jan 00

Last Warning : 0000Z 12 Jan 00

Max Intensity : 90 kts, Gusts to 110 kts

Landfall : None

Total Warnings : 14

Remarks : None

\* Name assigned by RSMC La Reunion

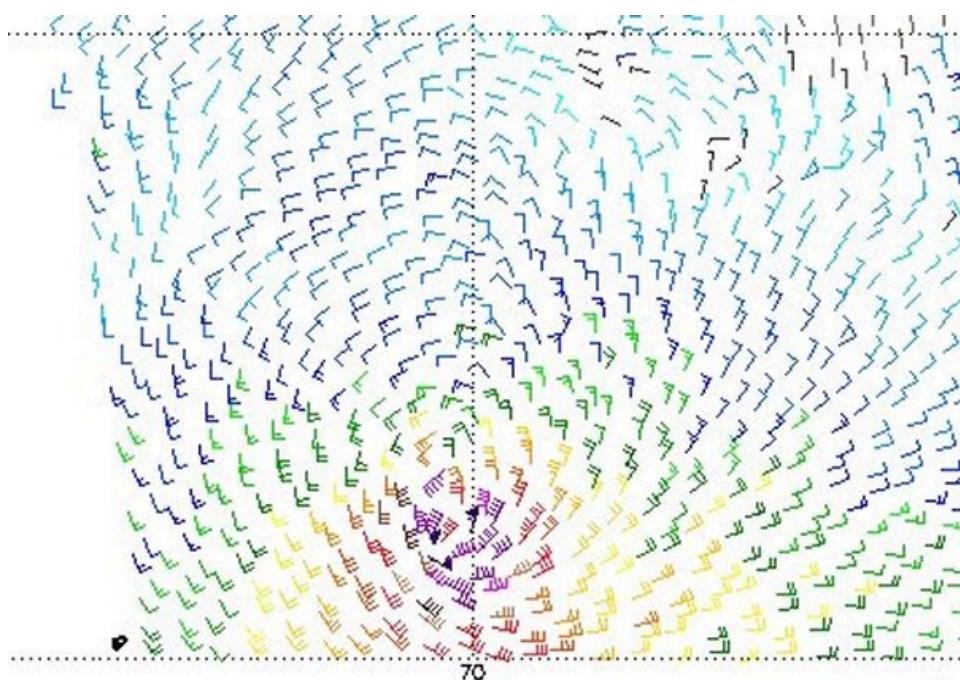


Figure 2-04S-1. 090119Z January 2000 QUIKSCAT image of TC 04S, located northeast of Mauritius, with core winds south to southwest of the center.

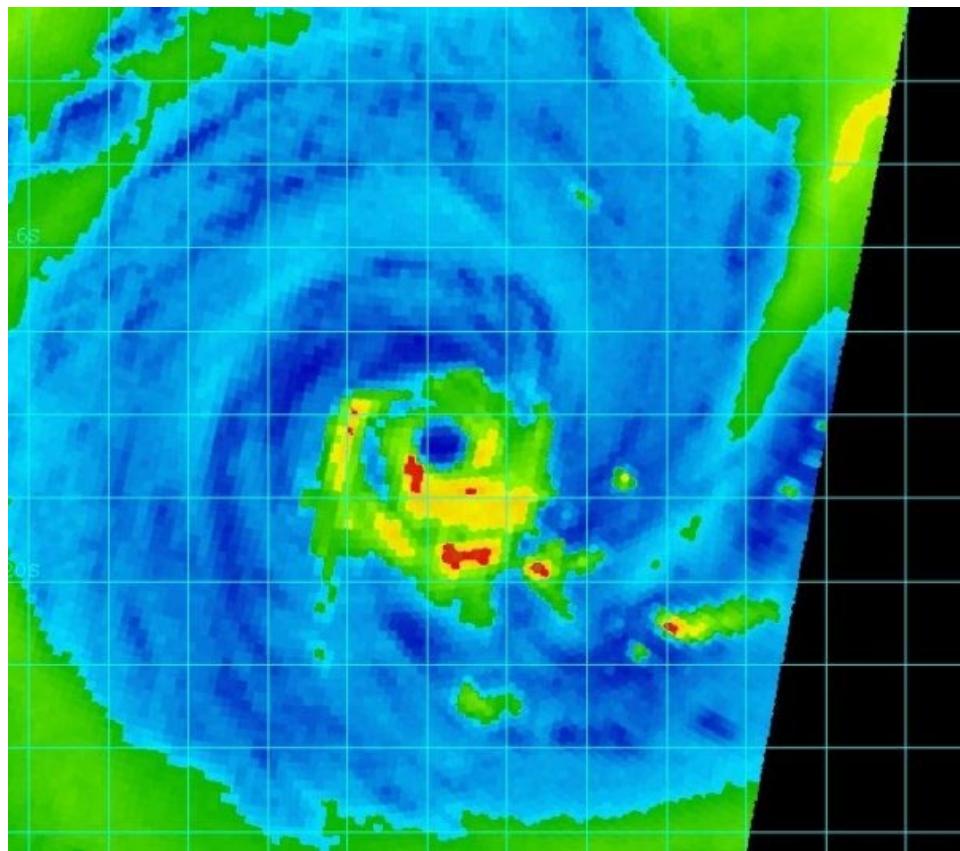
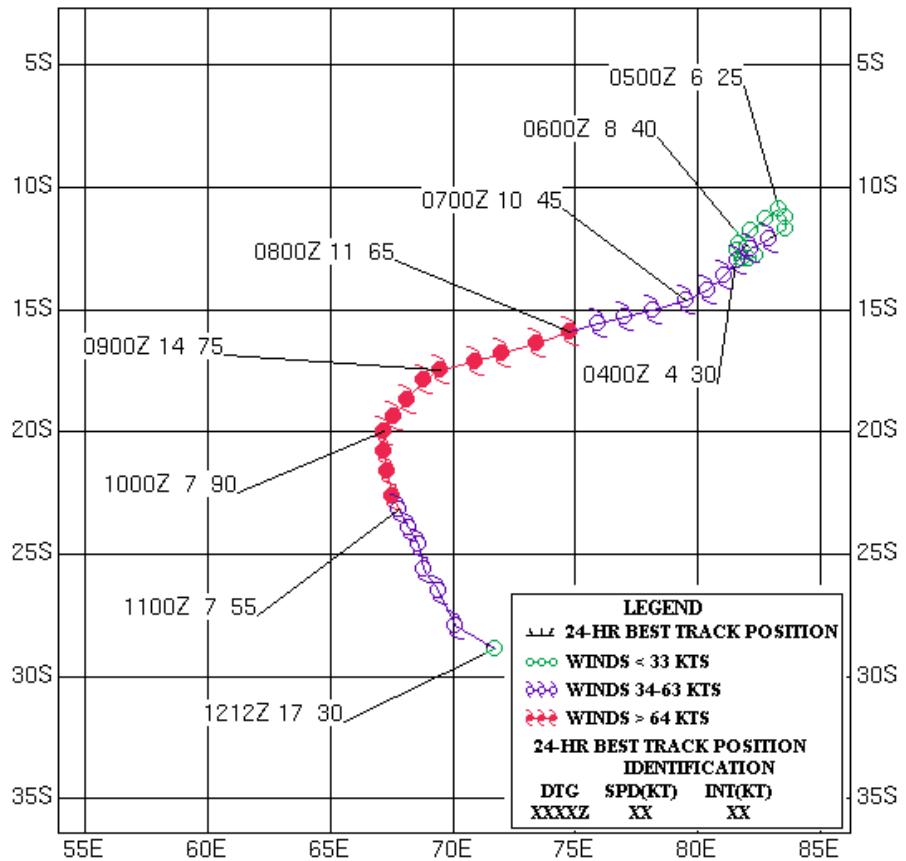


Figure 2-04S-2. 090406Z January 2000 TRMM 85 GHz image of TC 04S, with a 25 nm eye and banding feature south of the eye.

TROPICAL CYCLONE 04S (BABIOLA)  
05 - 12 JANUARY 2000



# **Tropical Cyclone (TC) 05P (Iris\*)**

First Poor : 0600Z 06 Jan 00

First Fair : 1900Z 06 Jan 00

First TCFA : 2330Z 06 Jan 00

First Warning : 1800Z 07 Jan 00

Last Warning : 1800Z 10 Jan 00

Max Intensity : 70 kts, Gusts to 85 kts

Landfall : None

Total Warnings : 7

Remarks : None

\* Name assigned by RSMC Nadi

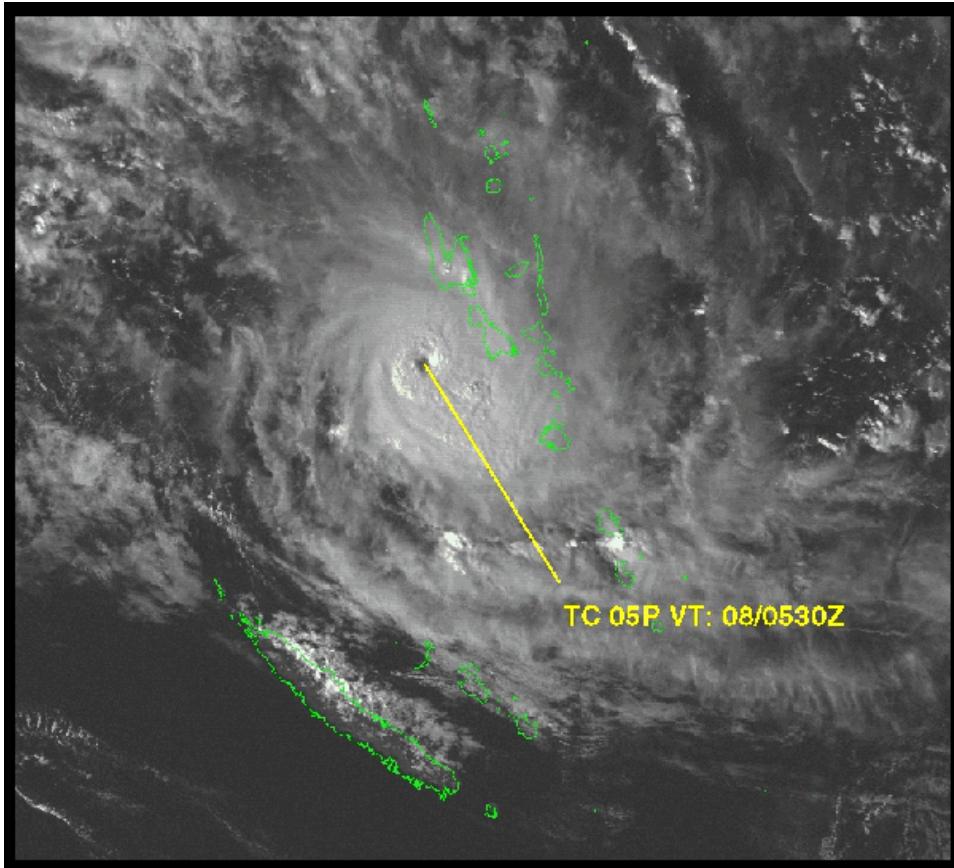
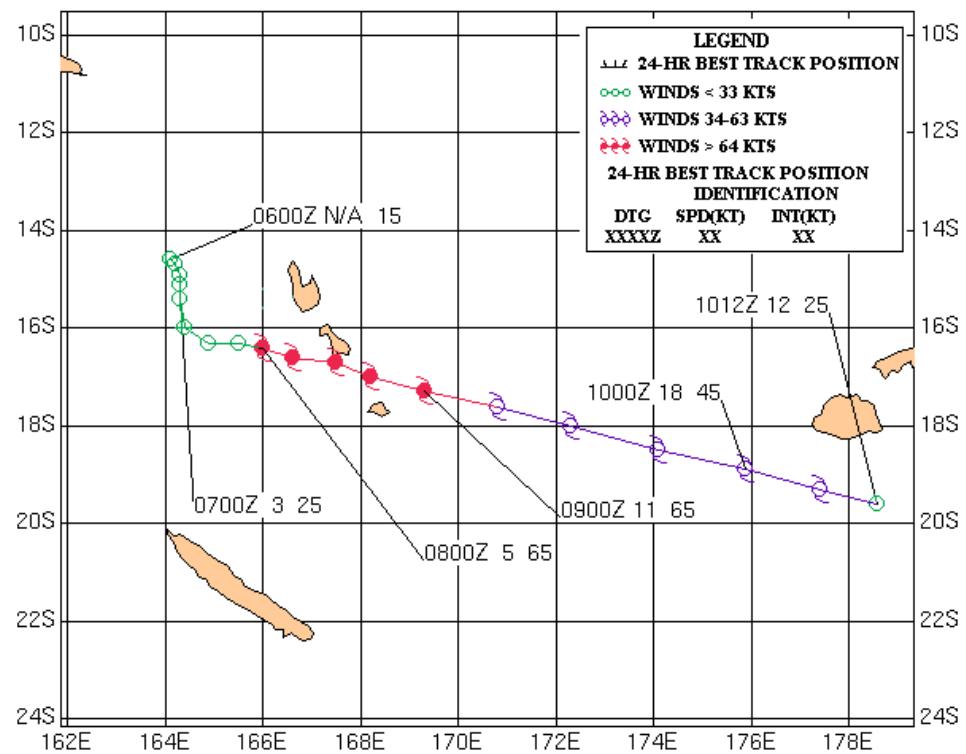


Figure 2-05P-1. 080530Z January 2000 visible satellite imagery of TC 05P as a tightly wrapped, symmetric system located just west of Malakula, Vanuatu.

TROPICAL CYCLONE 05P (IRIS)  
07 - 10 JANUARY 2000



# **Tropical Cyclone (TC) 06S**

First Poor : 1800Z 18 Jan 00

First Fair : 2300Z 18 Jan 00

First TCFA : 0230Z 20 Jan 00

First Warning : 0000Z 21 Jan 00

Last Warning : 0000Z 23 Jan 00

Max Intensity : 30 kts, Gusts to 40 kts

Landfall : 0000Z 23 Jan 00 west of Port Hedland, Australia

Total Warnings : 9

Remarks : None

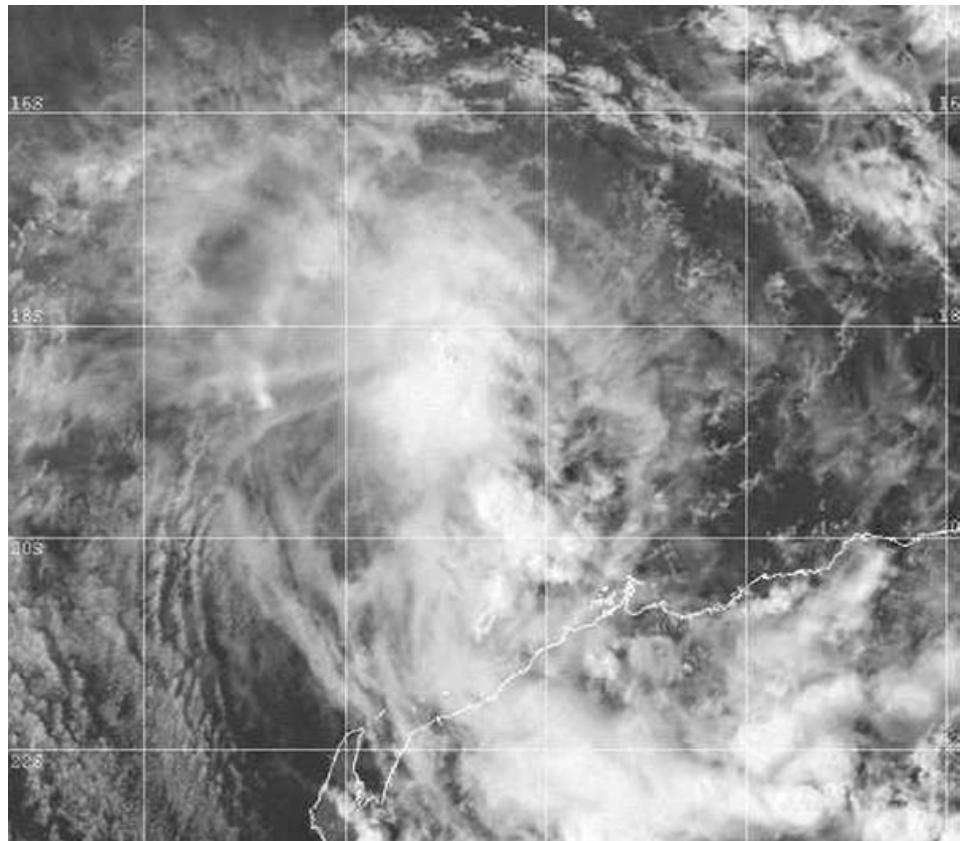
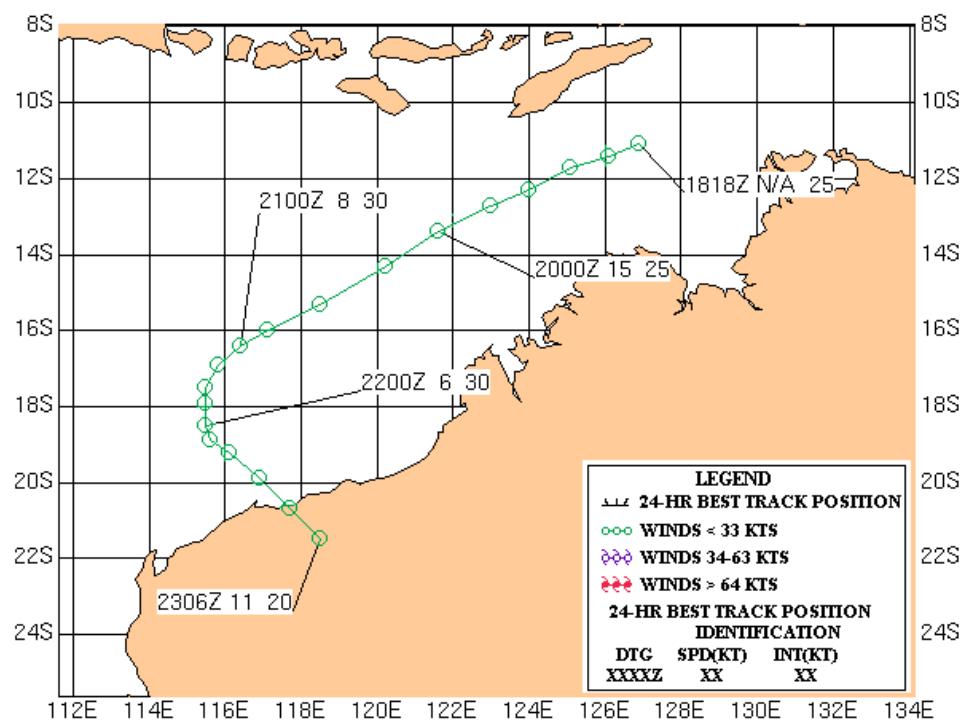


Figure 2-06S-1. 220631Z January 2000 visible satellite image of TC 06S, located about 210 nm north-northeast of Learmonth, Australia. At this time, the system was relatively unorganized with the majority of the convection confined to a small area west of the circulation center.

TROPICAL CYCLONE 06S  
21 - 23 JANUARY 2000



# **Tropical Cyclone (TC) 07P (Jo\*)**

First Poor : 0100Z 21 Jan 00

First Fair : 1700Z 21 Jan 00

First TCFA : 0800Z 23 Jan 00

First Warning : 0000Z 24 Jan 00

Last Warning : 0000Z 27 Jan 00

Max Intensity : 65 kts, Gusts to 80 kts

Landfall : None

Total Warnings : 7

Remarks : None

\* Name assigned by RSMC Nadi

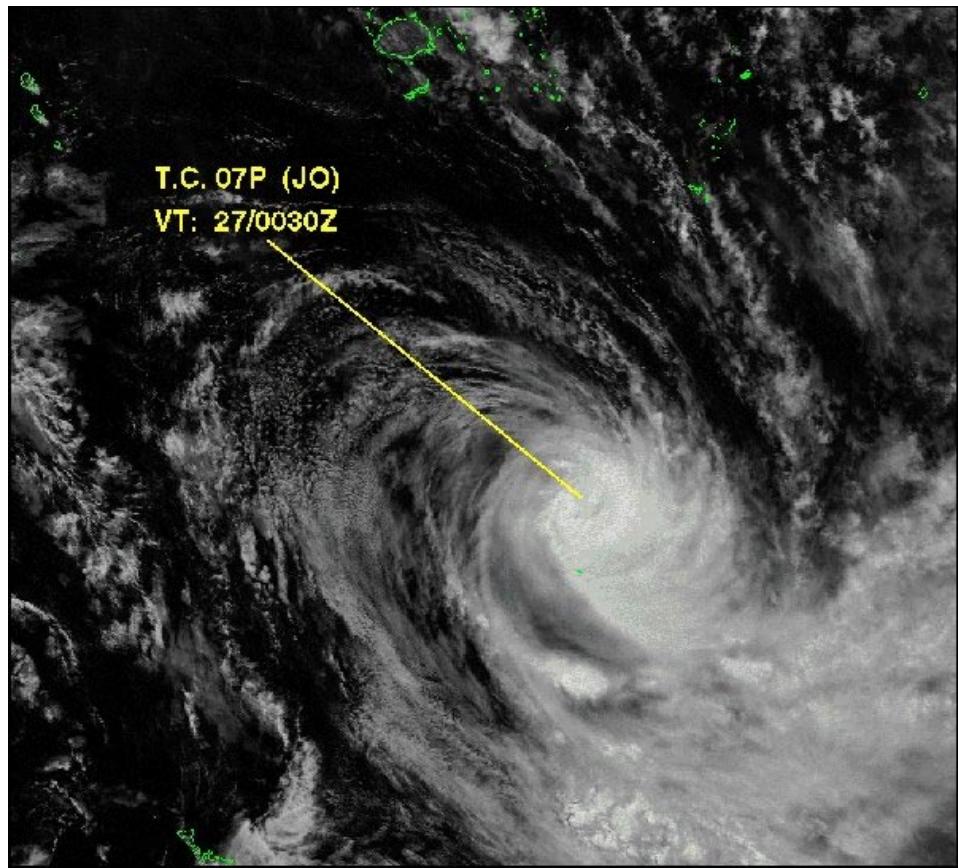
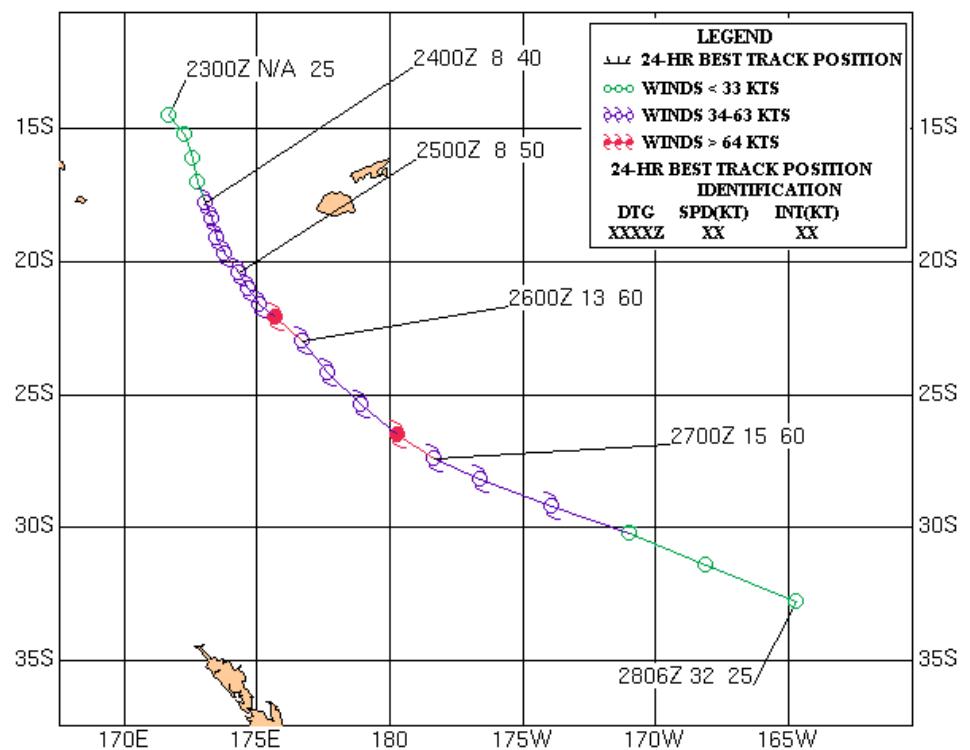


Figure 2-07P-1. 270030Z January 2000 visible satellite image of TC 07P, located south-southeast of the Fiji Islands. The cyclone was beginning its extra-tropical transition at this time, evident from the cold air stratocumulus clouds to the south and west of the circulation.

TROPICAL CYCLONE 07P (JO)  
24 - 27 JANUARY 2000



## **Tropical Cyclone (TC) 08S (Connie\*)**

First Poor : 0000Z 24 Jan 00

First Fair : 0700Z 25 Jan 00

First TCFA : 1000Z 25 Jan 00

First Warning : 1800Z 25 Jan 00

Last Warning : 0600Z 02 Feb 00

Max Intensity : 120 kts, Gusts to 145 kts

Landfall : None

Total Warnings : 25

Remarks:

(1) News reports indicated TC 08S caused two fatalities on Reunion Island, with 100 homes destroyed.

\* Name assigned by RSMC La Reunion

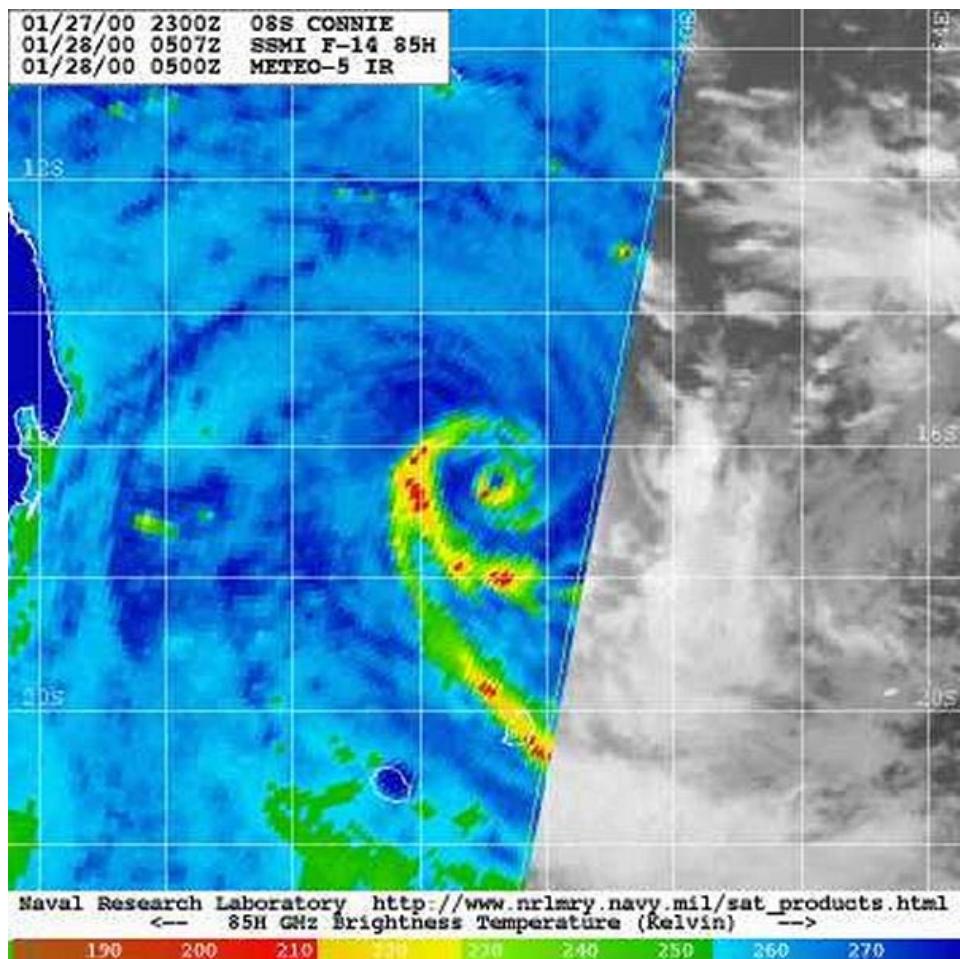
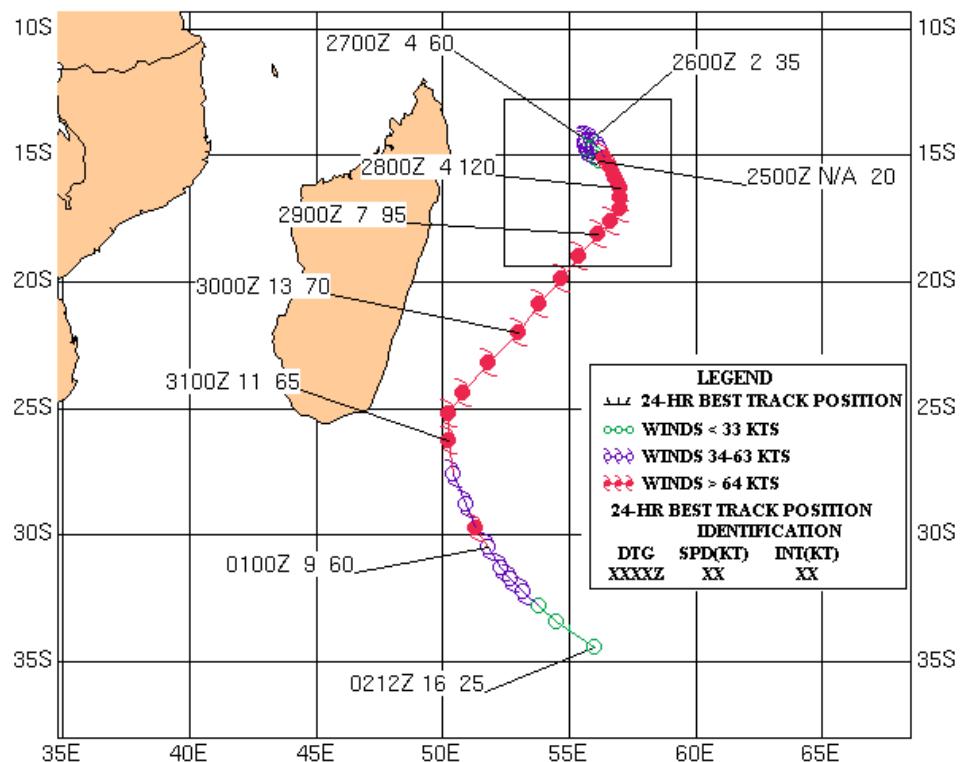
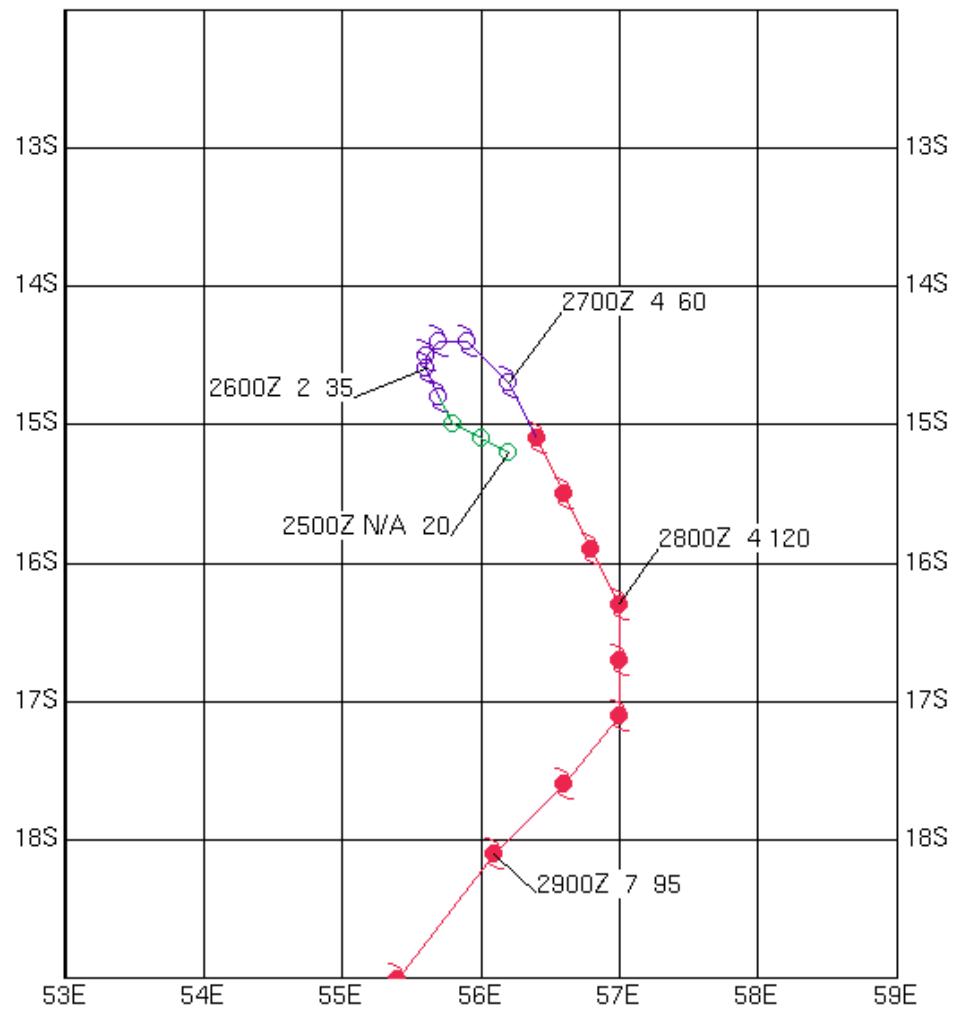


Figure 2-08S-1. 280507Z January 2000 SSMI 85 GHz image of TC 08S, located north-northeast of Reunion and Mauritius Islands, with estimated winds of 115 kts, a tightly wound eye, and rainbands south and west wrapping into the low-level circulation center.

TROPICAL CYCLONE 08S (CONNIE)  
25 JANUARY - 02 FEBRUARY 2000



See below to view inset detail



## **Tropical Cyclone (TC) 09S (KIRRILY\*)**

First Poor : 0500Z 23 Jan 00

First Fair : 0700Z 25 Jan 00

First TCFA : 2130Z 26 Jan 00

First Warning : 0600Z 27 Jan 00

Last Warning : 1800Z 01 Feb 00

Max Intensity : 85 kts, Gusts to 105 kts

Landfall : None

Total Warnings : 12

Remarks : None

\* Name assigned by Perth TCWC

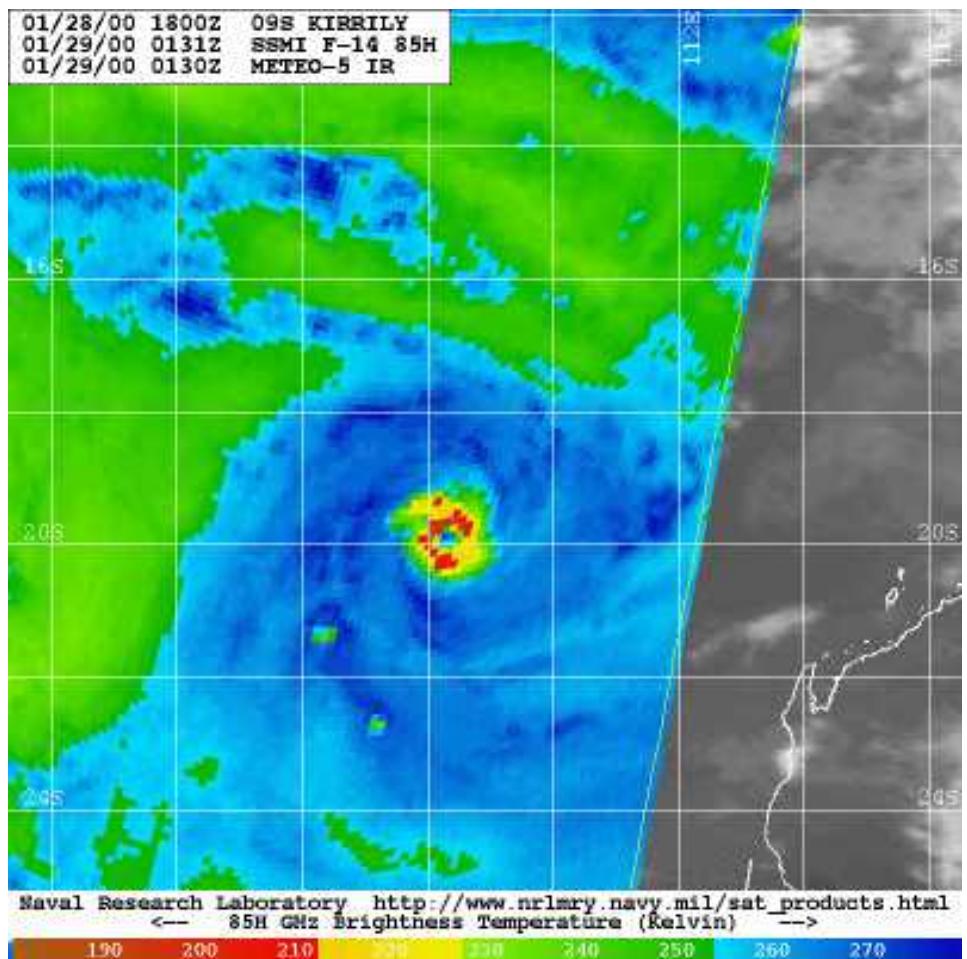
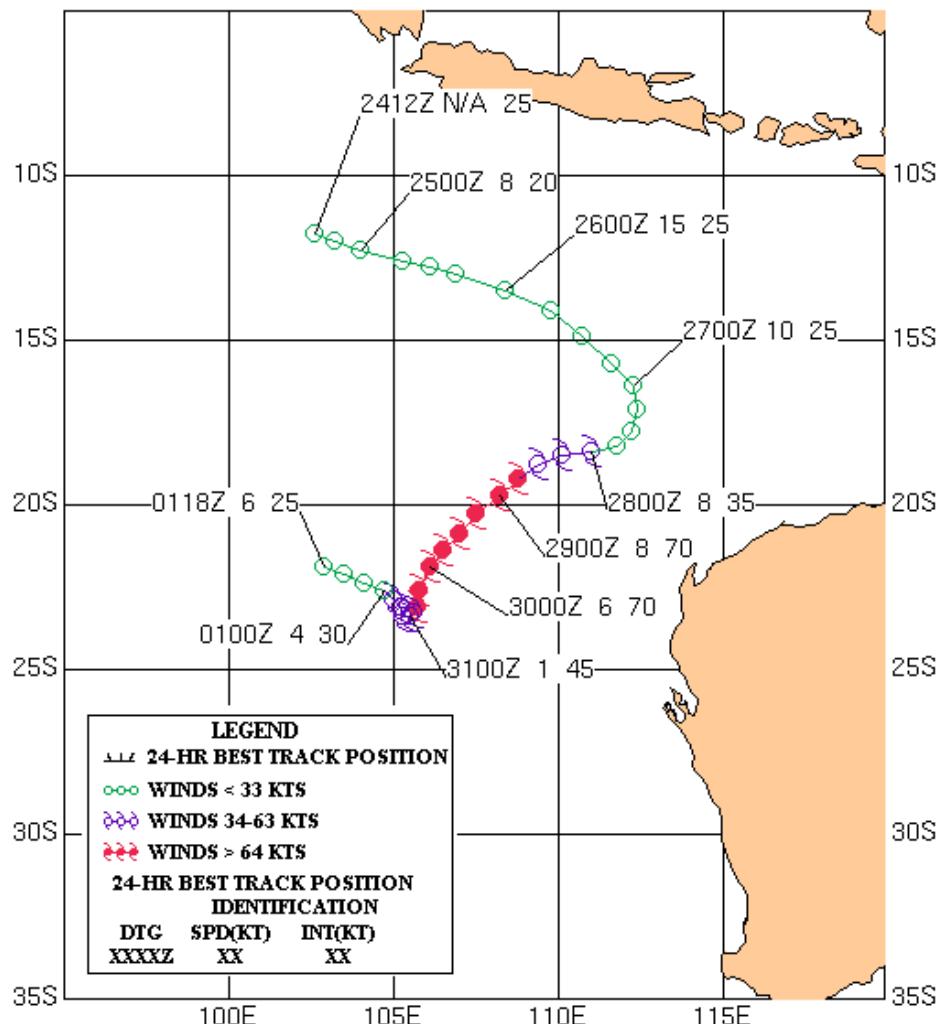


Figure 2-09S-1. 290131Z January 2000 SSMI 85 GHz image of TC 09S, located west-northwest of the Kimberly region of Western Australia, when the storm had an estimated intensity of 70 knots. The deep convection is limited solely to the thick eyewall at this time.

TROPICAL CYCLONE 09S (KIRRILY)  
27 JANUARY - 01 FEBRUARY 2000



## **Tropical Cyclone (TC) 10S (Damienne\*)**

First Poor : 0000Z 27 Jan 00

First Fair : 0500Z 31 Jan 00

First TCFA : 0130Z 01 Feb 00

First Warning : 1800Z 01 Feb 00

Last Warning : 1800Z 02 Feb 00

Max Intensity : 50 kts, Gusts to 65 kts

Landfall : None

Total Warnings : 3

Remarks : None

\* Name assigned by RSMC La Reunion

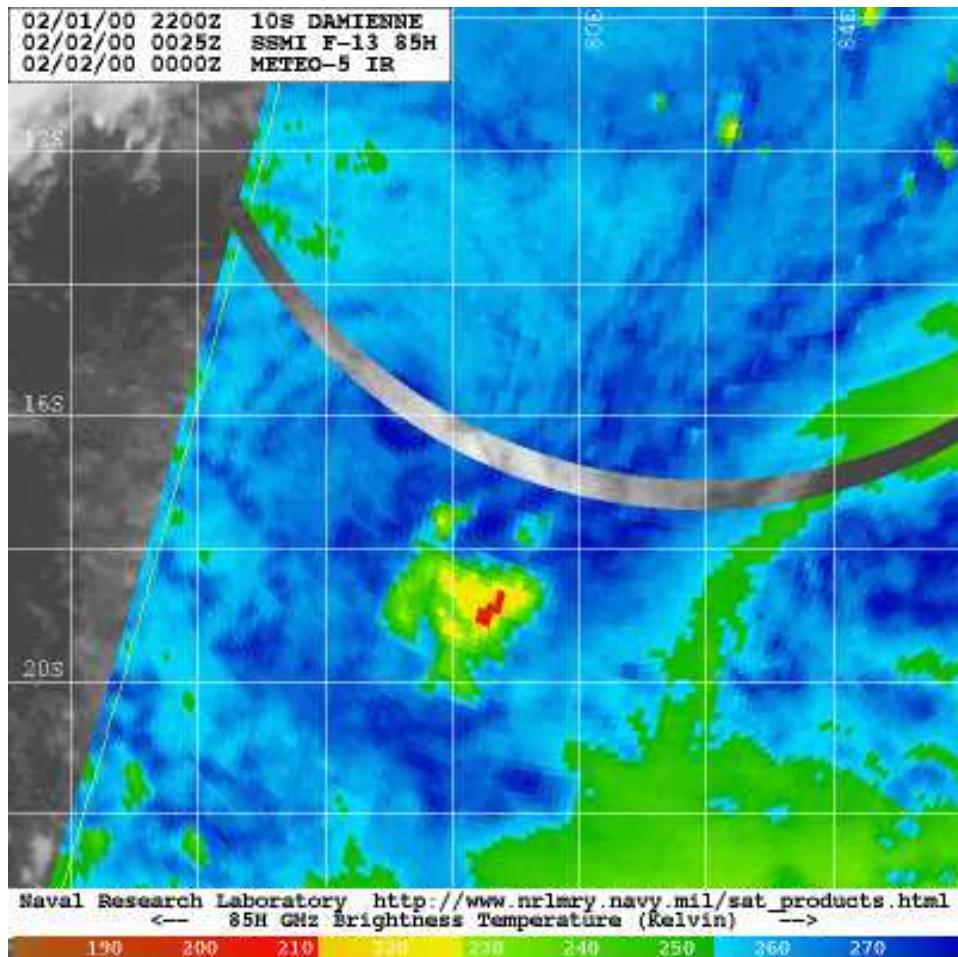
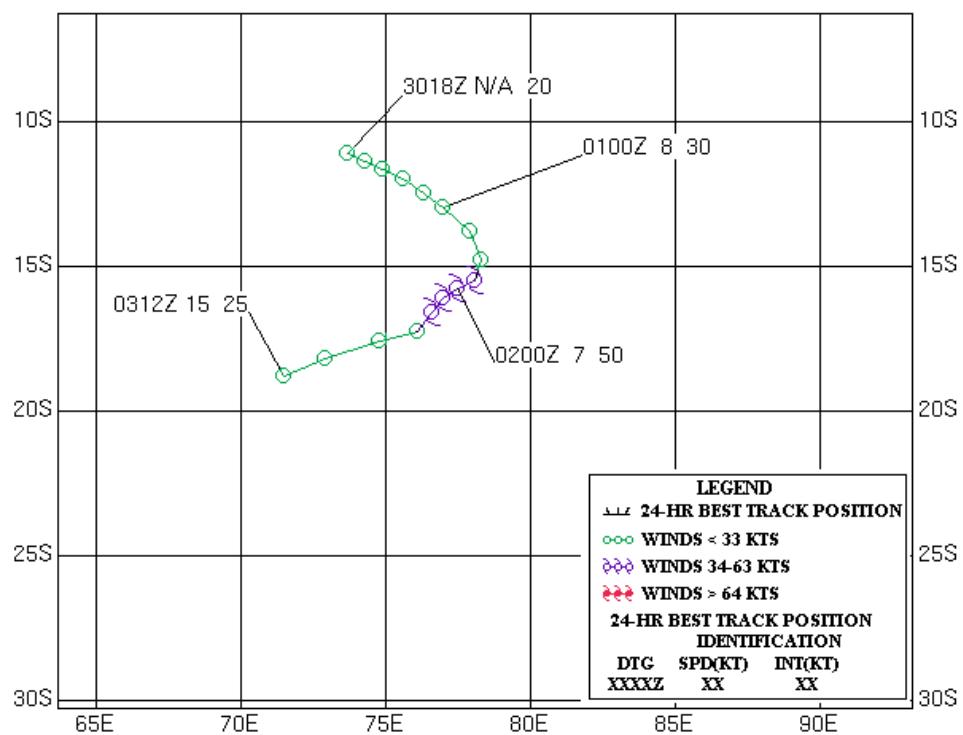


Figure 2-10S-1. 020025Z February 2000 SSMI 85 GHz image of TC 10S, located southeast of Diego Garcia with an estimated intensity of 50 knots. The low-level circulation is evident northwest of the convection, indicative of a high vertical wind shear environment.

TROPICAL CYCLONE 10S (DAMIENNE)  
01 - 02 FEBRUARY 2000



# **Tropical Cyclone (TC) 11S (Leone-Eline\*)**

First Poor : 1800Z 02 Feb 00

First Fair : 0300Z 03 Feb 00

First TCFA : 1400Z 03 Feb 00

First Warning : 0000Z 04 Feb 00

Last Warning : 0000Z 23 Feb 00

Max Intensity : 115 kts, Gusts to 140 kts

Landfall : 1600Z 17 Feb 00 over Madagascar; 1730Z 22 Feb 00 over Mozambique

Total Warnings : 44

Remarks:

- (1) Reuters reported 5 fatalities and thousands left homeless when TC 11S made landfall in Madagascar.
- (2) TC 11S made landfall over Mozambique with winds in excess of 85 kts. According to Reuters, flooding caused by the cyclone killed over 200 people and left a half million homeless.
- (3) The Associated Press reported that continued flooding from TC 11S and TC 15S killed an estimated 700 people.

\* Leone assigned by Perth TCWC Eline assigned by RSMC La Reunion

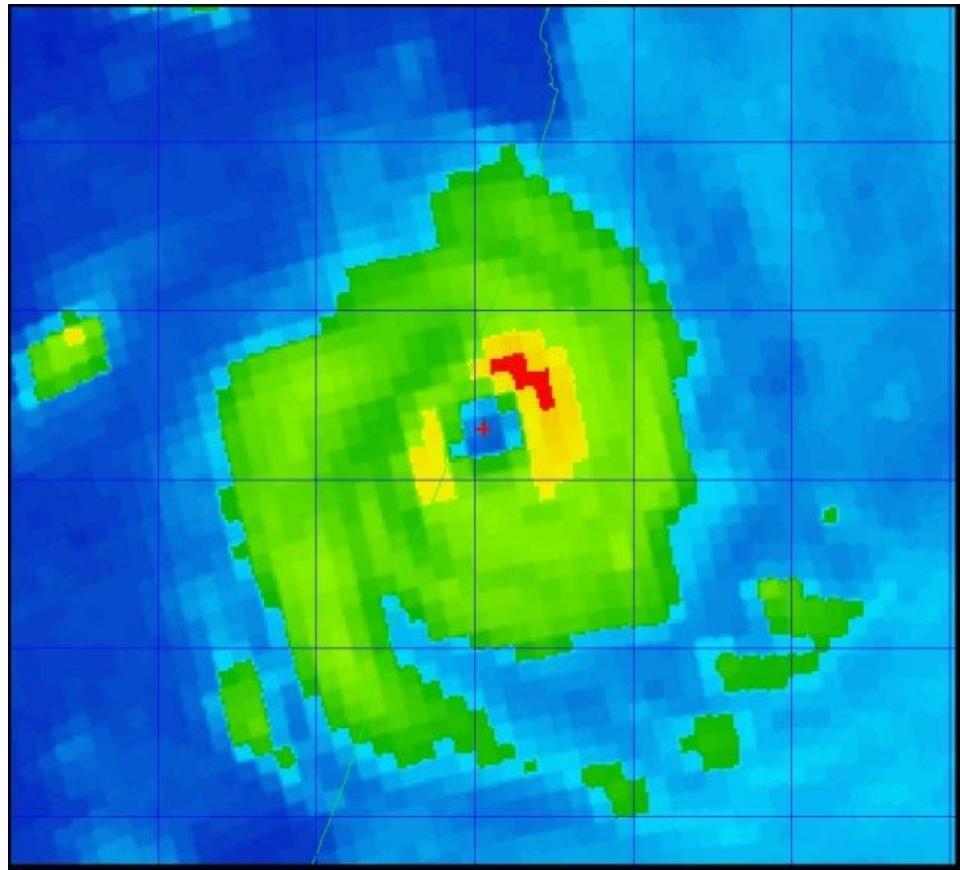


Figure 2-11S-1. 171455Z February 2000 SSMI 85 GHz image of TC 11S, located on the eastern coast of central Madagascar, with a 16 nm eye and estimated best track winds of 80 kts.

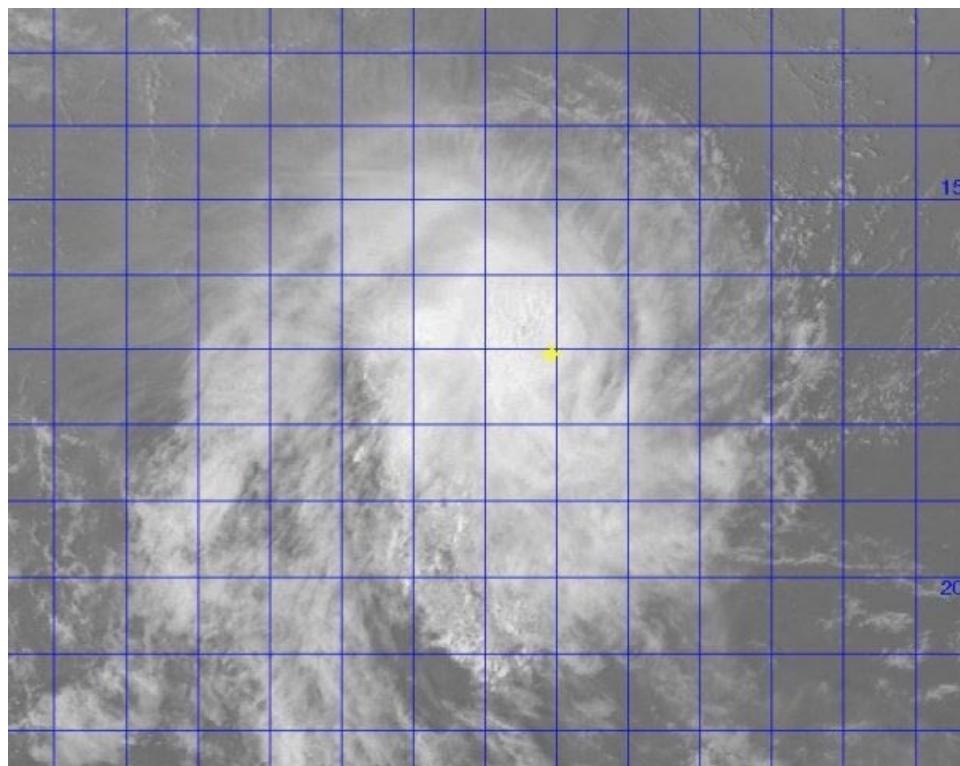
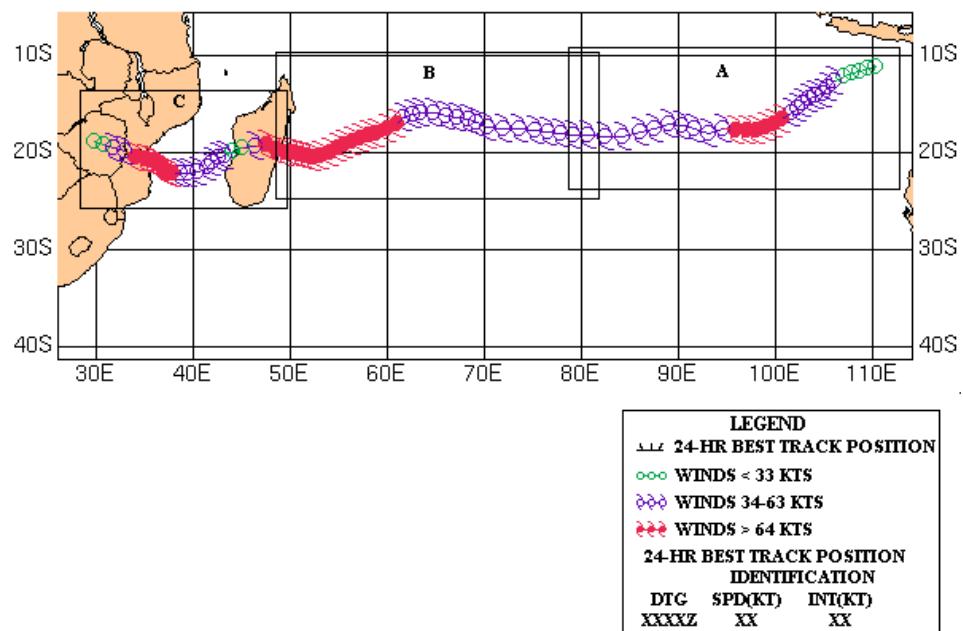
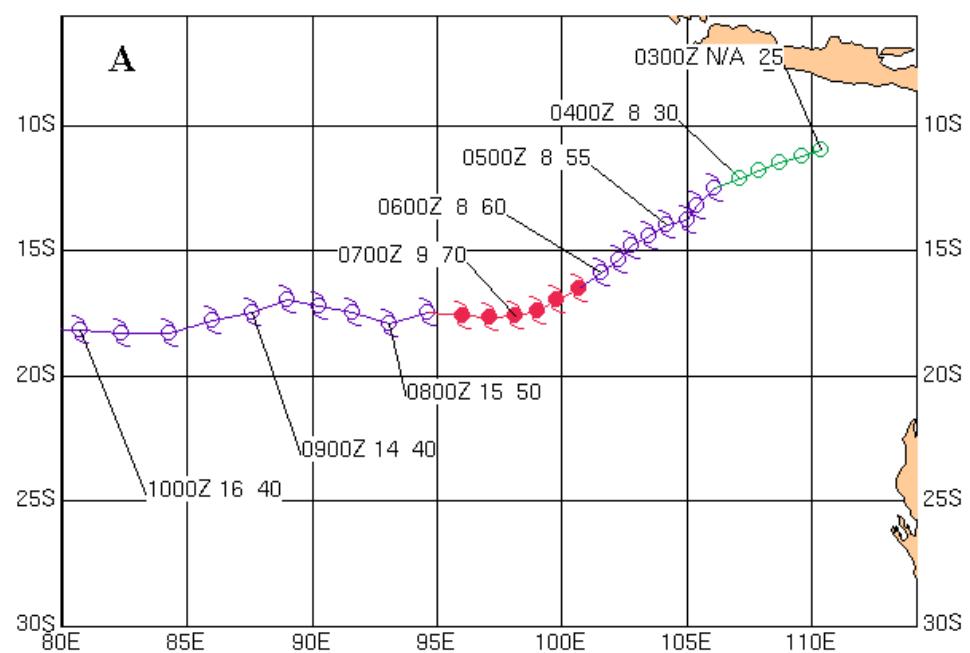


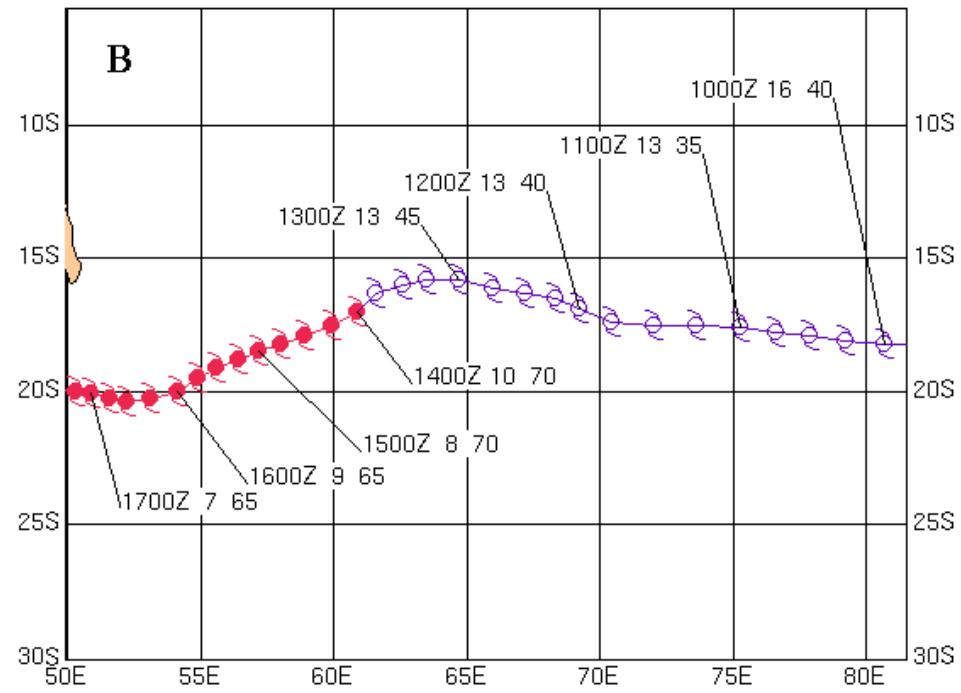
Figure 2-11S-2. 020830Z February 2000 visible satellite image of TC 11S, with deep convection obscuring the low-level circulation center.

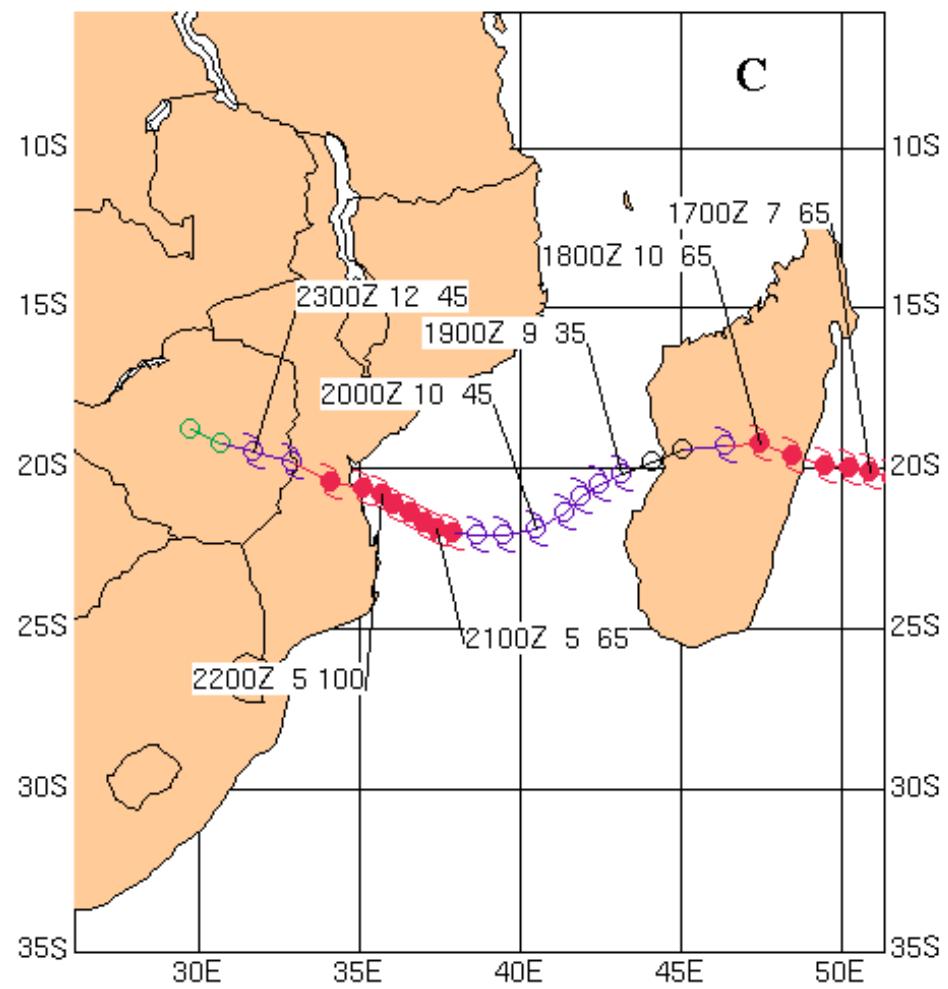
TROPICAL CYCLONE 11S (LEONE-ELINE)  
04 - 23 FEBRUARY 2000



See below to view insets "A", "B", and "C" detail







# Tropical Cyclone (TC) 12S (Felicia\*)

First Poor : 1800Z 17 Feb 00

First Fair : 0800Z 19 Feb 00

First TCFA : 0530Z 20 Feb 00

First Warning : 0000Z 21 Feb 00

Last Warning : 0000Z 24 Feb 00

Max Intensity : 65 kts, Gusts to 80 kts

Landfall : None

Total Warnings : 7

Remarks : None

\* Name assigned by RSMC La Reunion

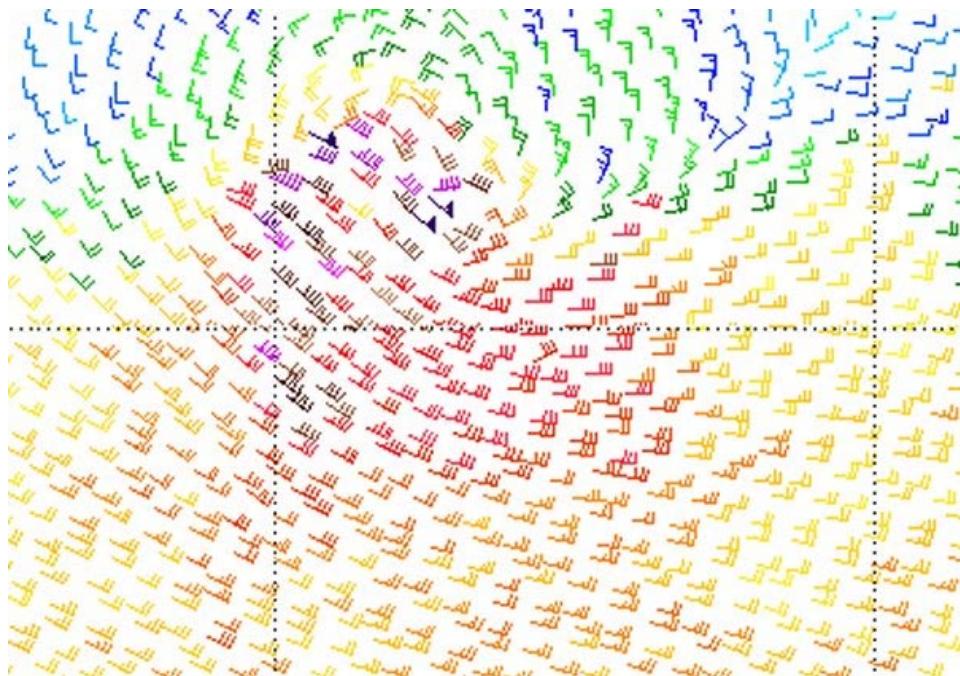
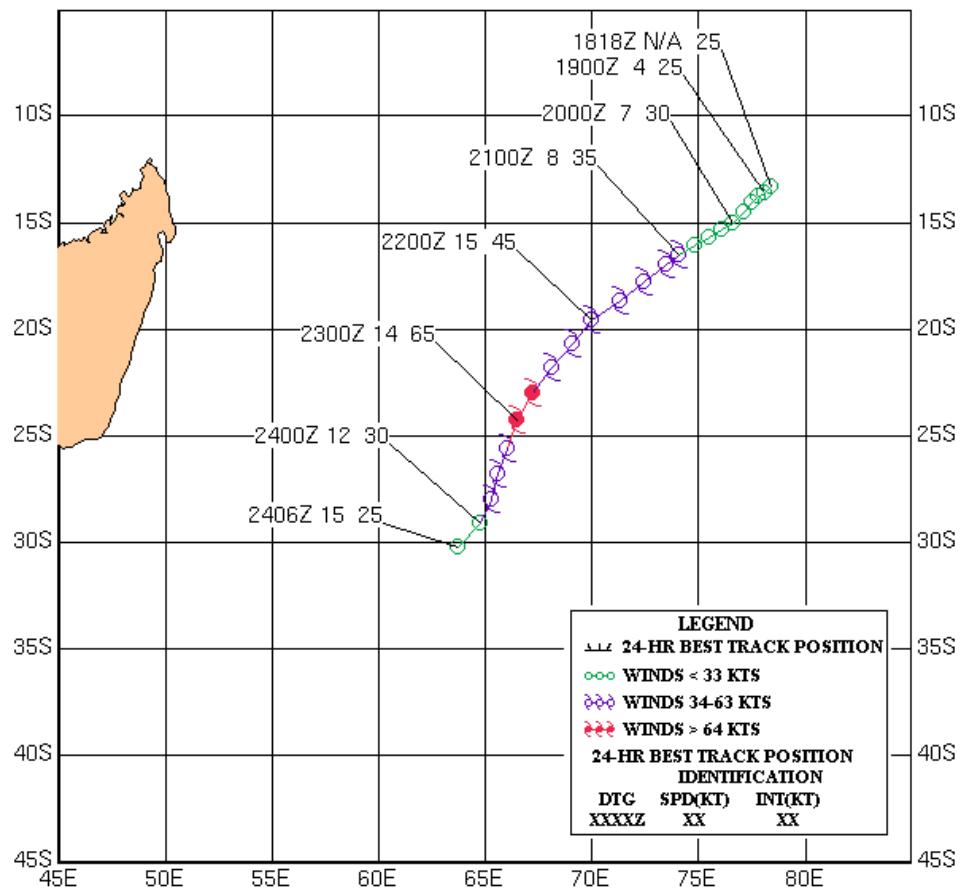


Figure 2-12S-1. 211250Z February 2000 QUIKSCAT image of TC 12S, located south of Diego Garcia. At this time, the maximum winds are concentrated on the southern quadrants of the circulation.

TROPICAL CYCLONE 12S (FELICIA)  
21 - 24 FEBRUARY 2000



## **Tropical Cyclone 13P (Kim\*)**

First Poor : No Advisory east of 180 degrees

First Fair : No Advisory east of 180 degrees

First TCFA : 1730Z 23 Feb 00

First Warning : 0600Z 24 Feb 00

Last Warning : 1800Z 29 Feb 00

Max Intensity : 100 kts, Gusts to 125 kts

Landfall : None

Total Warnings : 12

Remarks : None

\* Name assigned by RSMC Nadi

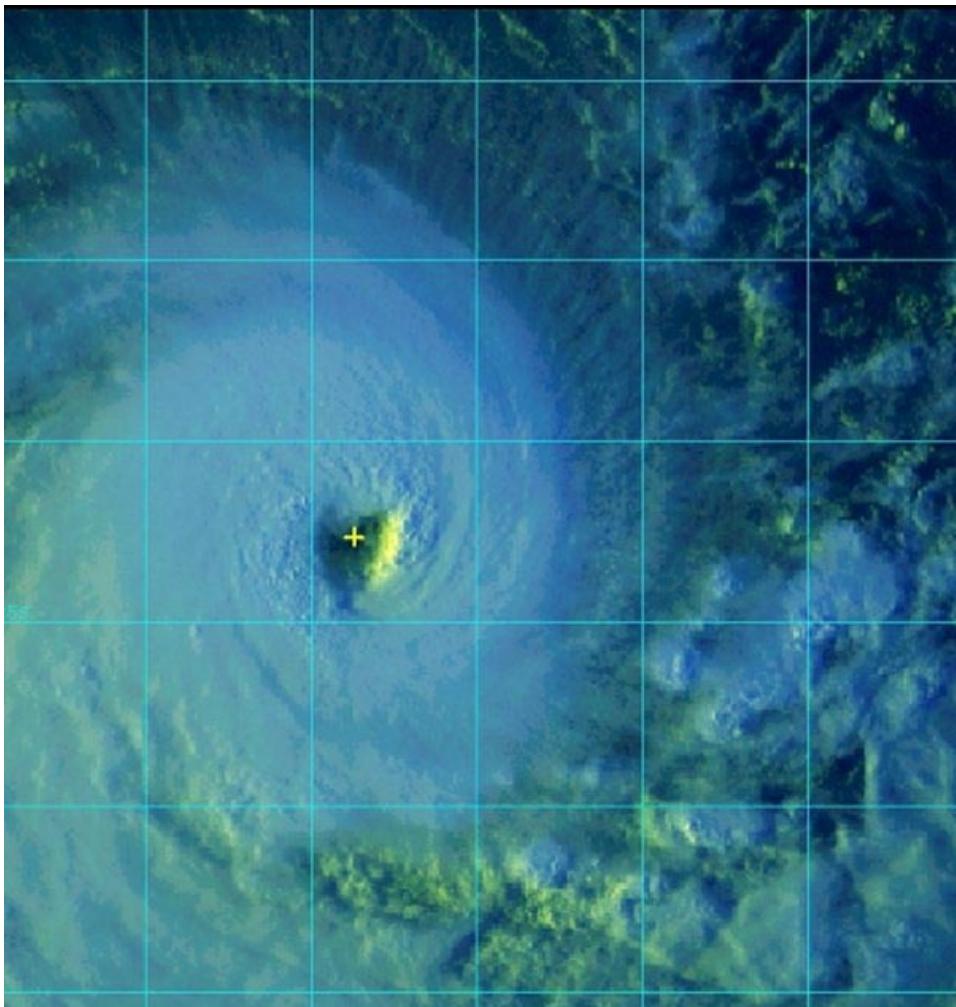
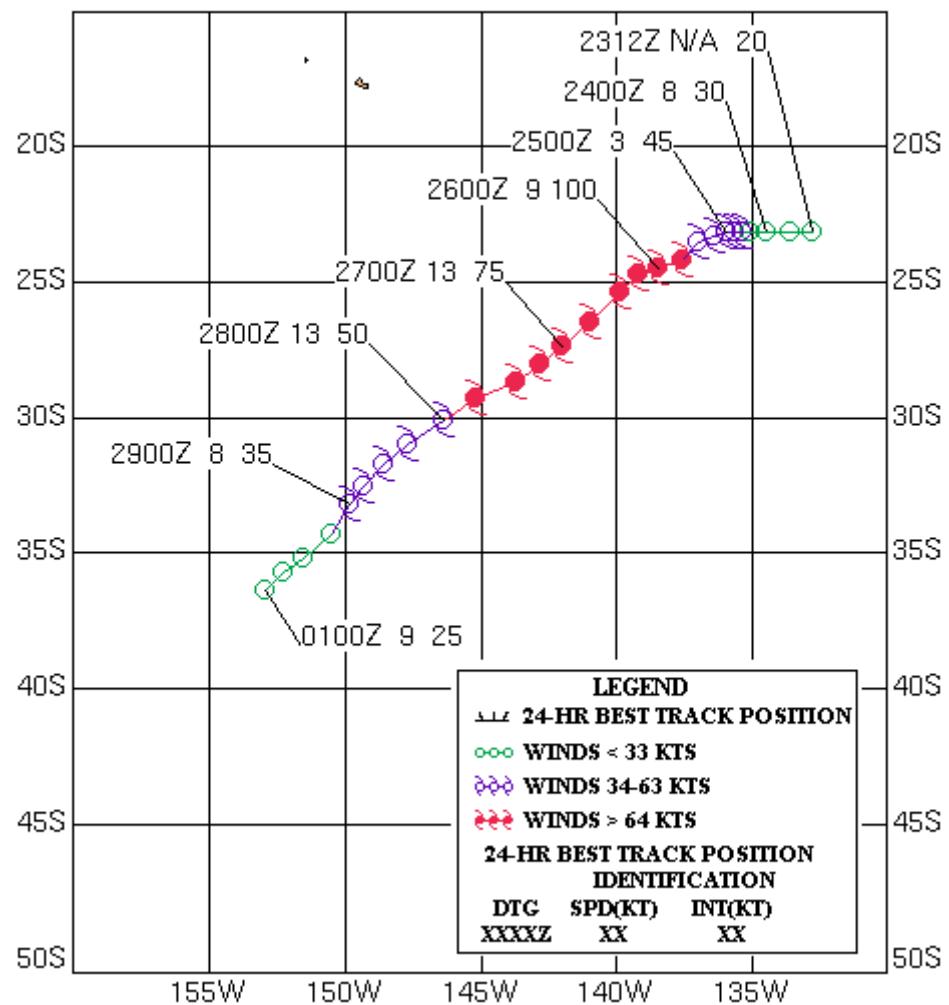


Figure 1-13P-1. 260222Z February 2000 multi-spectral satellite image of TC 13P, located south-east of Tahiti with an estimated intensity of 100 knots. A slightly irregular eye is evident in this image.

TROPICAL CYCLONE 13P (KIM)  
23 FEBRUARY - 01 MARCH 2000



# **Tropical Cyclone (TC) 14P (Steve\*)**

First Poor : 0600Z 24 Feb 00

First Fair : 1700Z 25 Feb 00

First TCFA : 0100Z 26 Feb 00

First Warning : 1800Z 26 Feb 00

Last Warning : 1200Z 10 Mar 00

Max Intensity : 65 kts, Gusts to 80 kts

Landfall : 0600Z 27 Feb 00 over Cape York Peninsula; 1800Z 29 Feb 00 over Northern Territory; 1200Z 06 Mar 00 over the Dampier coast; 1200Z 09 Mar 00 south of Carnarvon

Total Warnings : 36

Remarks:

(1) TC 14P skirted the northern coast of Australia, making landfall four times.

\* Name assigned by Brisbane TCWC

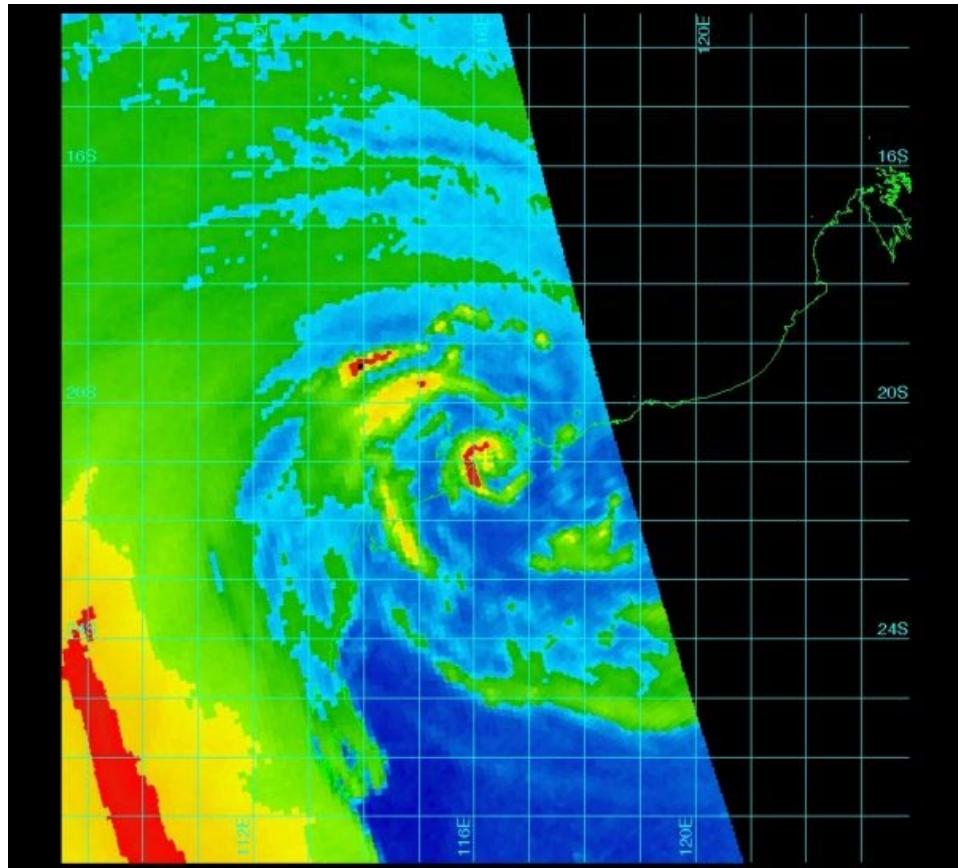


Figure 2-14P-1. 061405Z March 2000 SSMI 85 GHz of TC 14P, as the cyclone made landfall over the Dampier coast of Western Australia with an estimated best track intensity of 65 knots. Note the convective band evident west of the low-level circulation center.

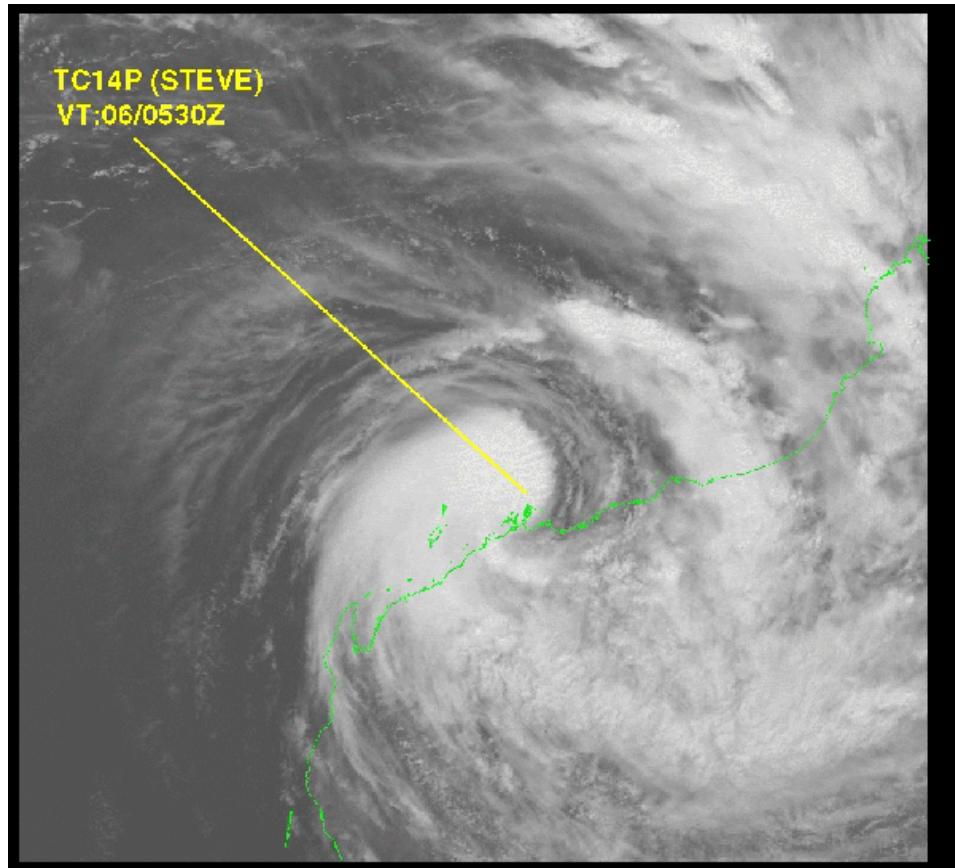
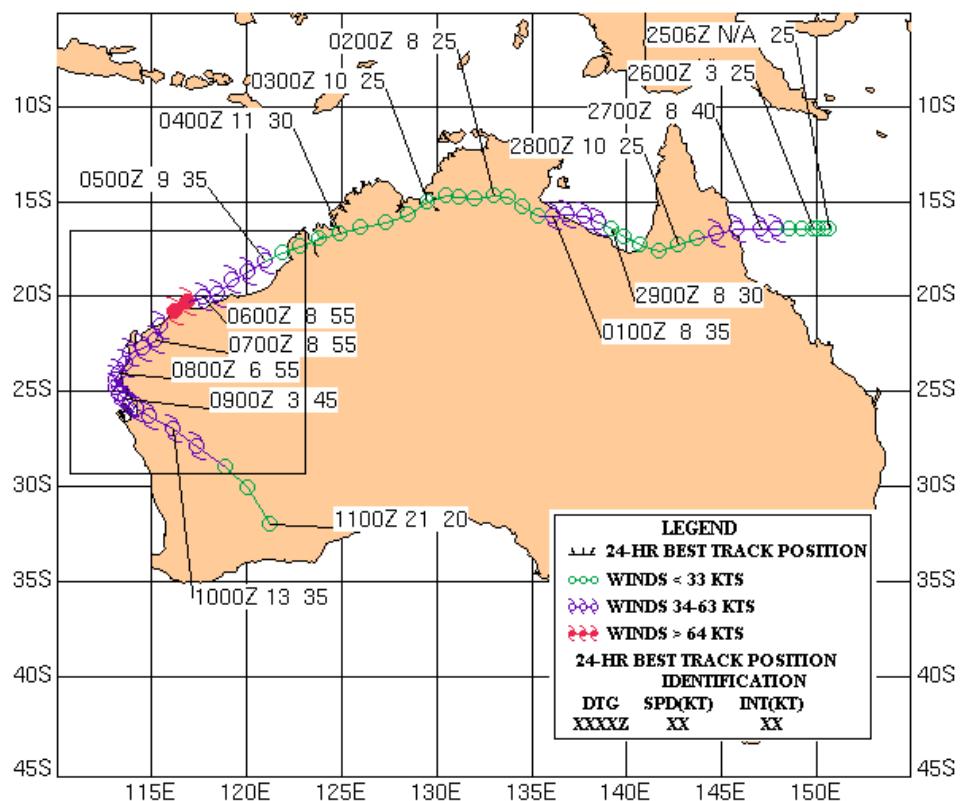
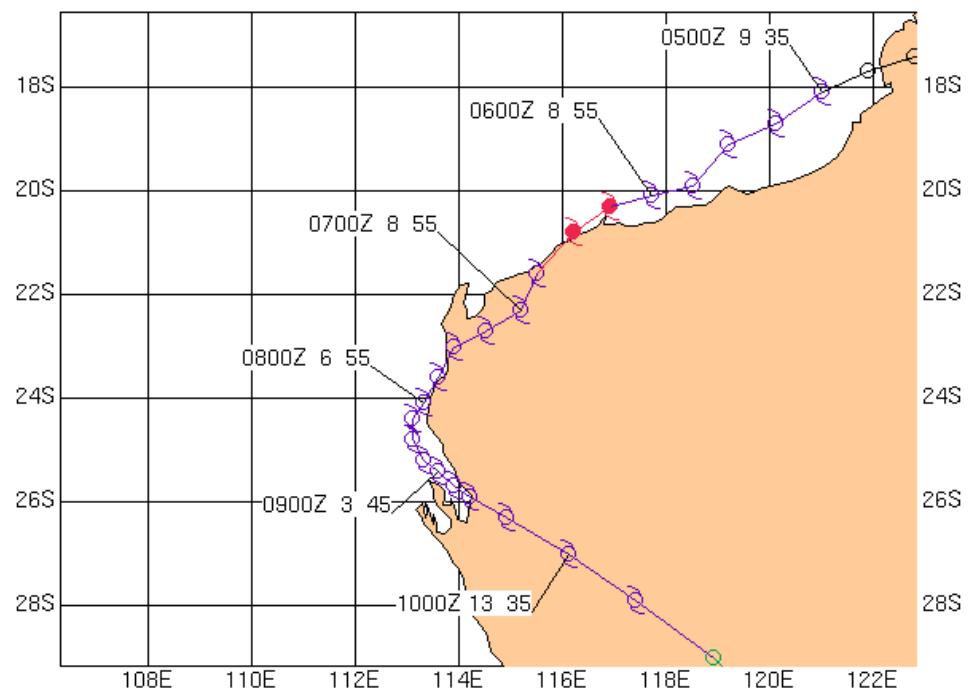


Figure 2-14p-2. A 060530Z March 2000 visible satellite image of TC 14P, when the cyclone was located just over the Dampier coast of Western Australia, with estimated winds of 65 knots.

TROPICAL CYCLONE 14P (STEVE)  
26 FEBRUARY - 10 MARCH 2000



See below to view inset detail



## **Tropical Cyclone (TC) 15S (Gloria\*)**

First Poor : None

First Fair : 0000Z 27 Feb 00

First TCFA : 0930Z 27 Feb 00

First Warning : 1200Z 28 Feb 00

Last Warning : 0600Z 05 Mar 00

Max Intensity : 50 kts, Gusts to 65 kts

Landfall : 1800Z 01 Mar 00 over northern Madagascar

Total Warnings : 20

Remarks : None

\* Name assigned by RSMC La Reunion

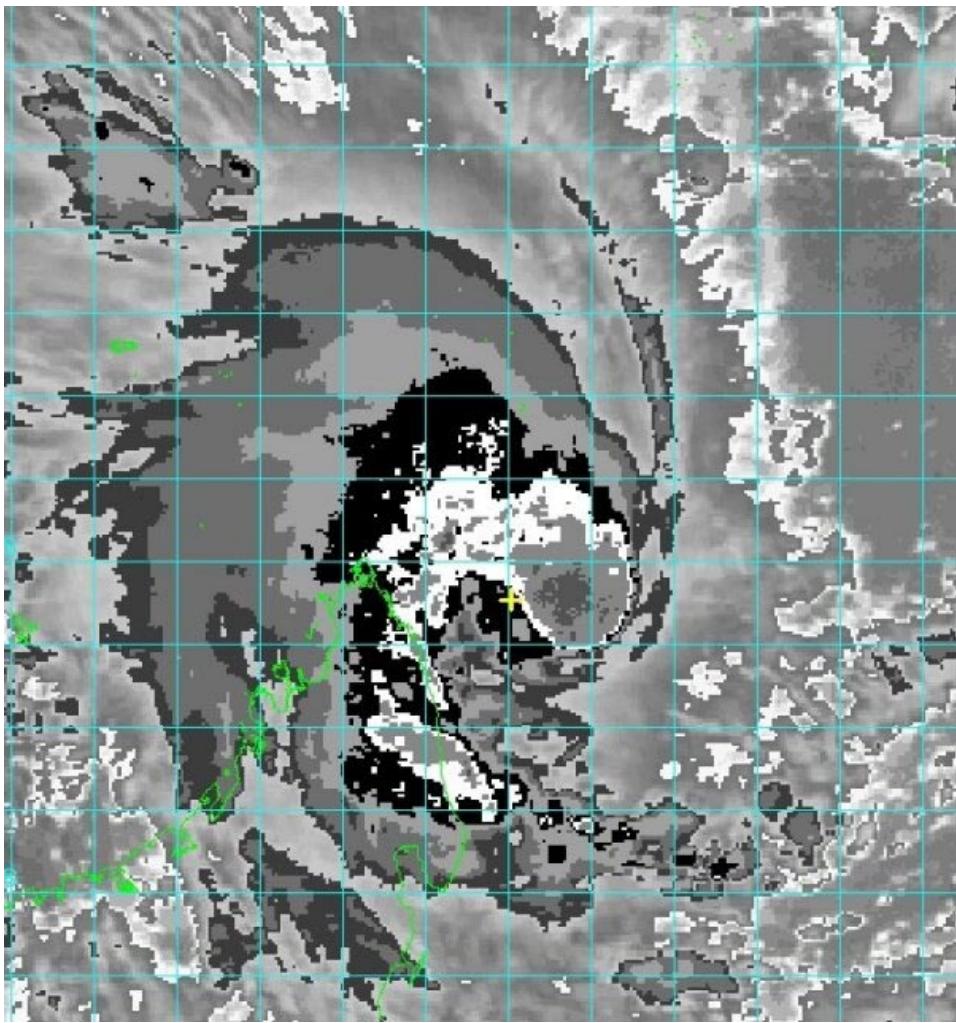
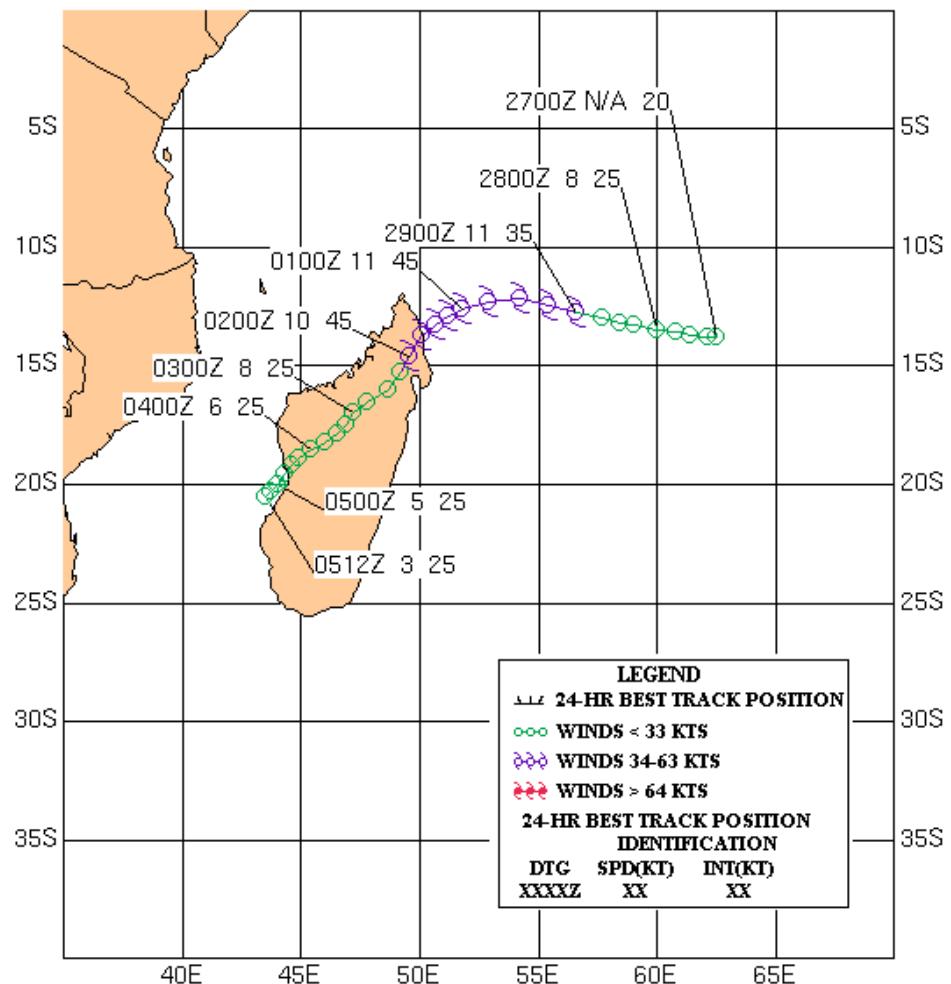


Figure 2-15S-1. 010230Z March 2000 enhanced infrared satellite image of TC 15S, located just northeast of Madagascar with an estimated intensity of 45 knots. Vertical shear is evident, with most convective activity displaced westward from the low-level circulation center.

TROPICAL CYCLONE 15S (GLORIA)  
28 FEBRUARY - 05 MARCH 2000



## **Tropical Cyclone (TC) 16S (Norman\*)**

First Poor : None

First Fair : None

First TCFA : 1600Z 29 Feb 00

First Warning : 0600Z 01 Mar 00

Last Warning : 1800Z 08 Mar 00

Max Intensity : 120 kts, Gusts to 145 kts

Landfall : None

Total Warnings : 16

Remarks : None

\* Name assigned by Perth TCWC

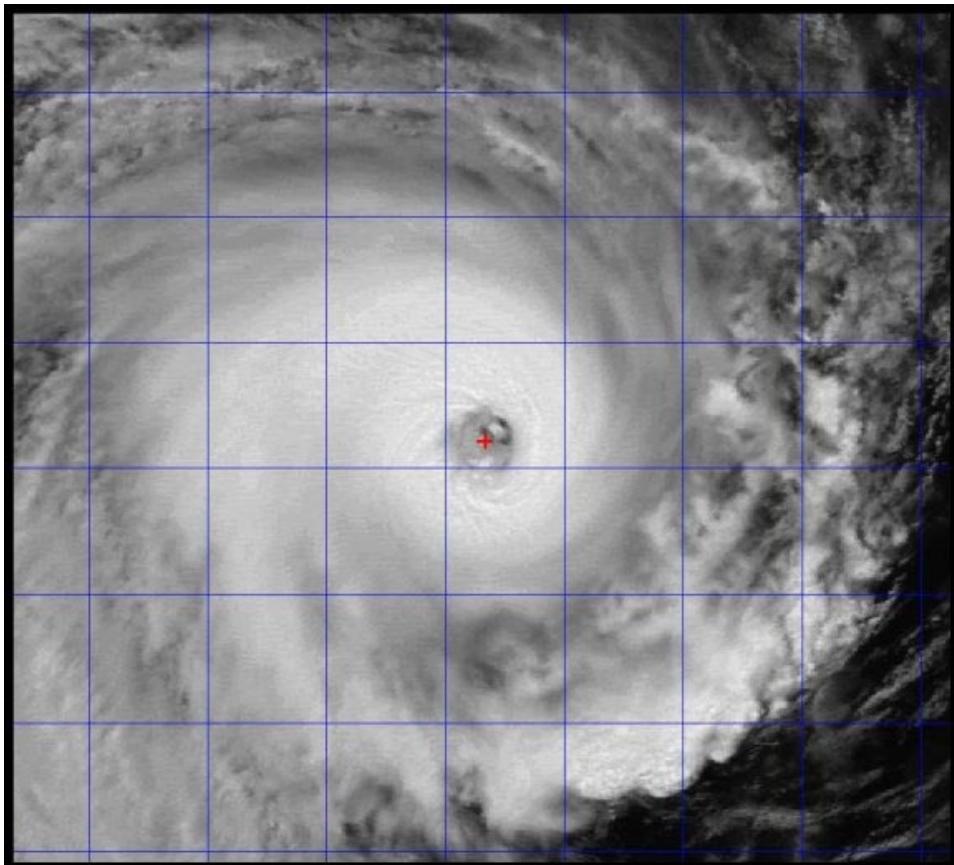
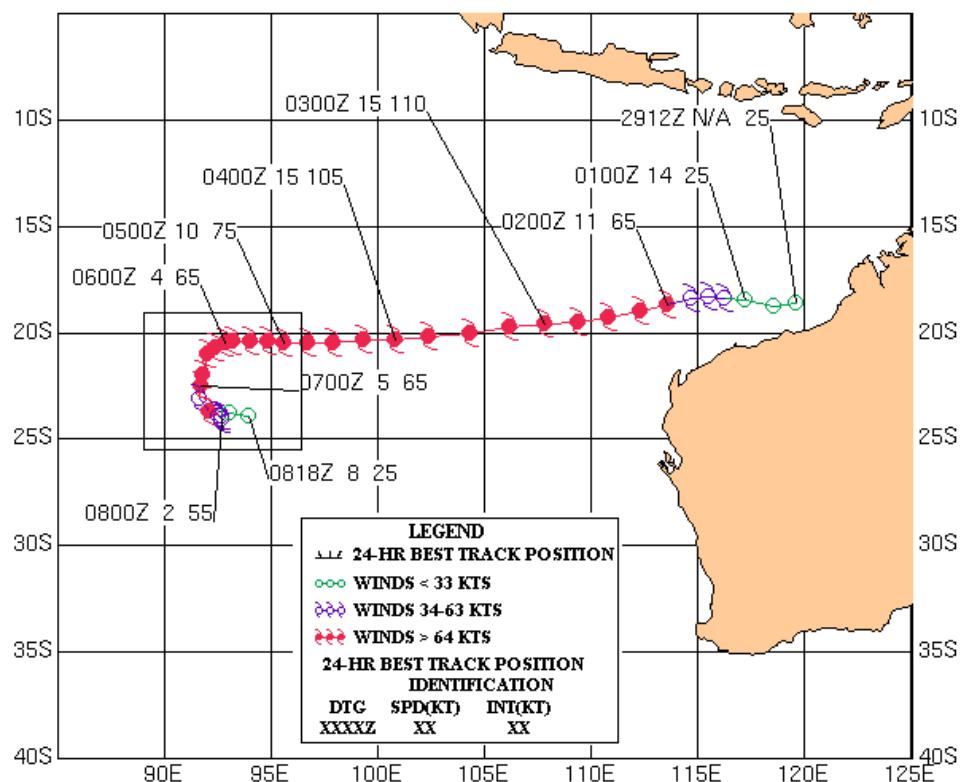
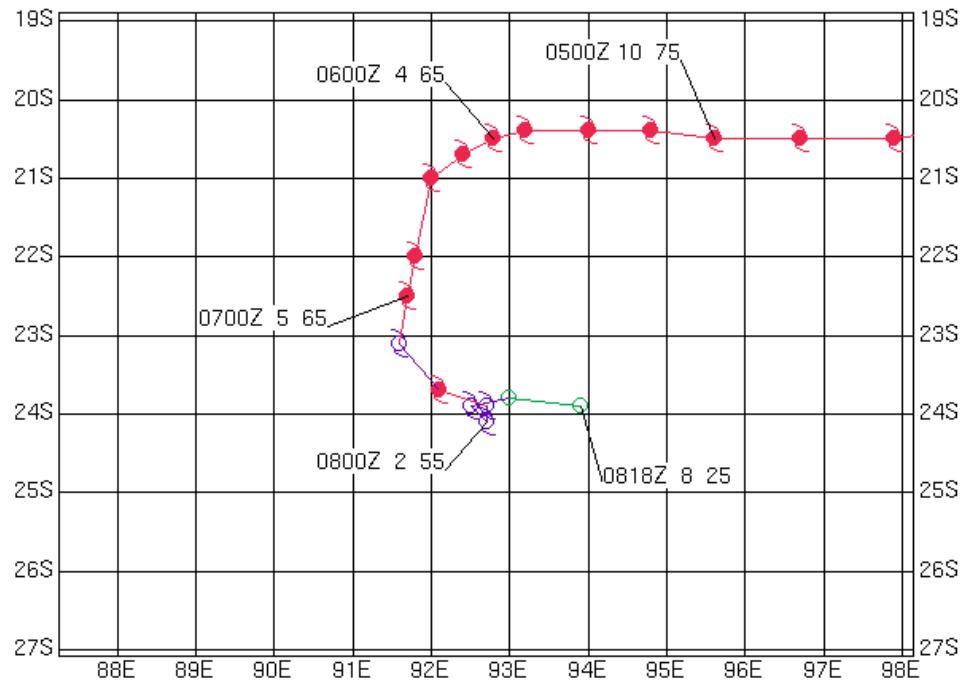


Figure 2-16S-1. 030530Z March 2000 visible satellite image of TC 16S, located about 500 nm west-northwest of Learmonth, Australia. At this time, the cyclone has a well-defined eye and estimated intensity of 120 knots.

TROPICAL CYCLONE 16S (NORMAN)  
01 - 08 MARCH 2000



See below to view inset detail



## **Tropical Cyclone (TC) 17S**

First Poor : None

First Fair : 1800Z 28 Feb 00

First TCFA : 1300Z 29 Feb 00

First Warning : 1200Z 01 Mar 00

Last Warning : 0000Z 05 Mar 00

Max Intensity : 35 kts, Gusts to 45 kts

Landfall : None

Total Warnings : 8

Remarks : None

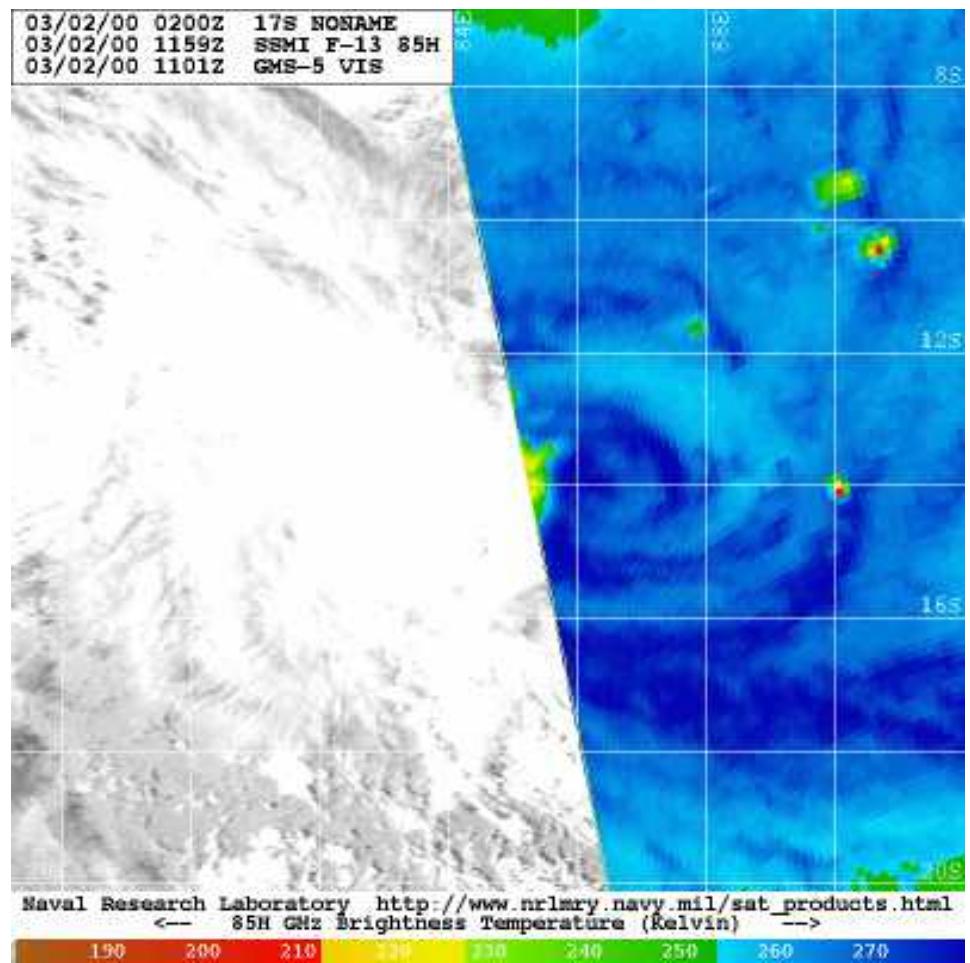
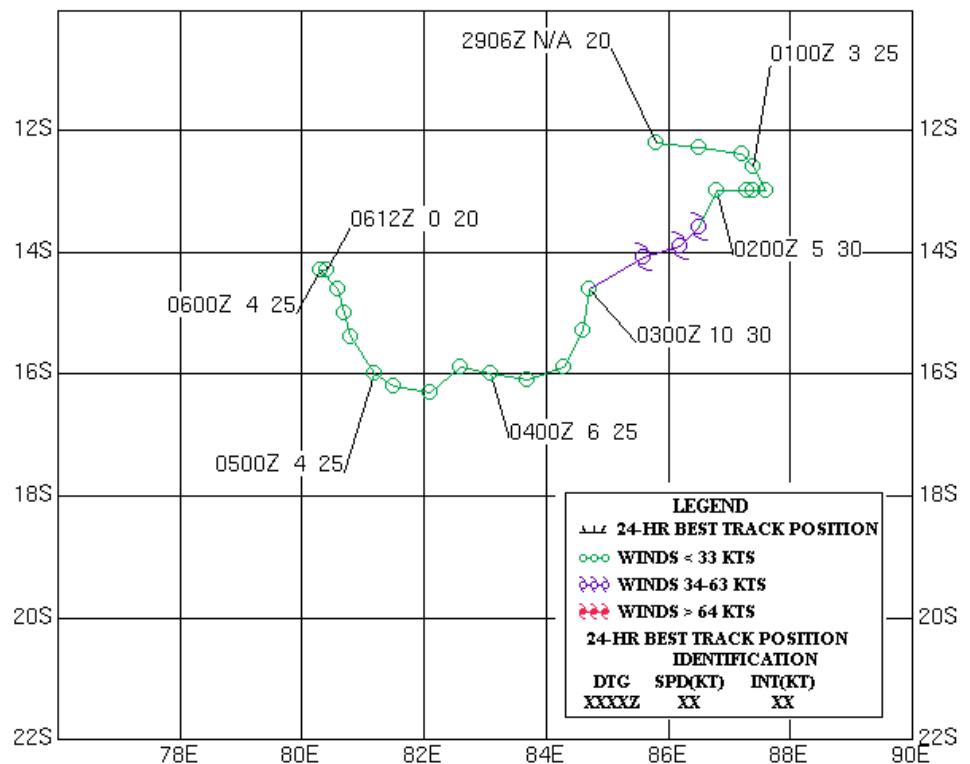


Figure 2-17S-1. 021159Z March 2000 SSMI 85 GHz image of TC 17S, located east-southeast of Diego Garcia and west of Cocos Island. At this time, the low-level circulation center is fully exposed east of the deep convection (seen in the overlaid visible image), indicative of strong vertical shear.

TROPICAL CYCLONE 17S  
01 - 05 MARCH 2000



## **Tropical Cyclone (TC) 18P (Leo\*)**

First Poor : No Advisory east of 180 degrees

First Fair : No Advisory east of 180 degrees

First TCFA : 2130Z 04 Mar 00

First Warning : 1200Z 05 Mar 00

Last Warning : 0600Z 08 Mar 00

Max Intensity : 55 kts, Gusts to 70 kts

Landfall : None

Total Warnings : 5

Remarks : None

\* Name assigned by RSMC Nadi

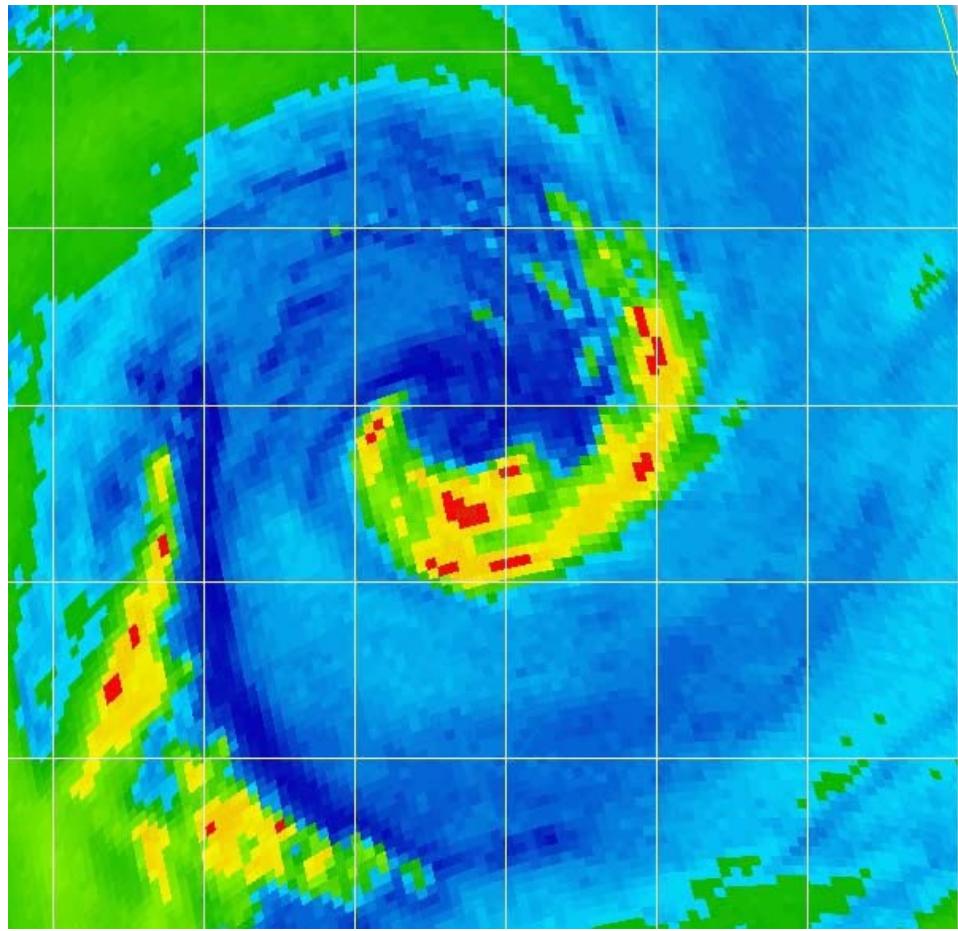
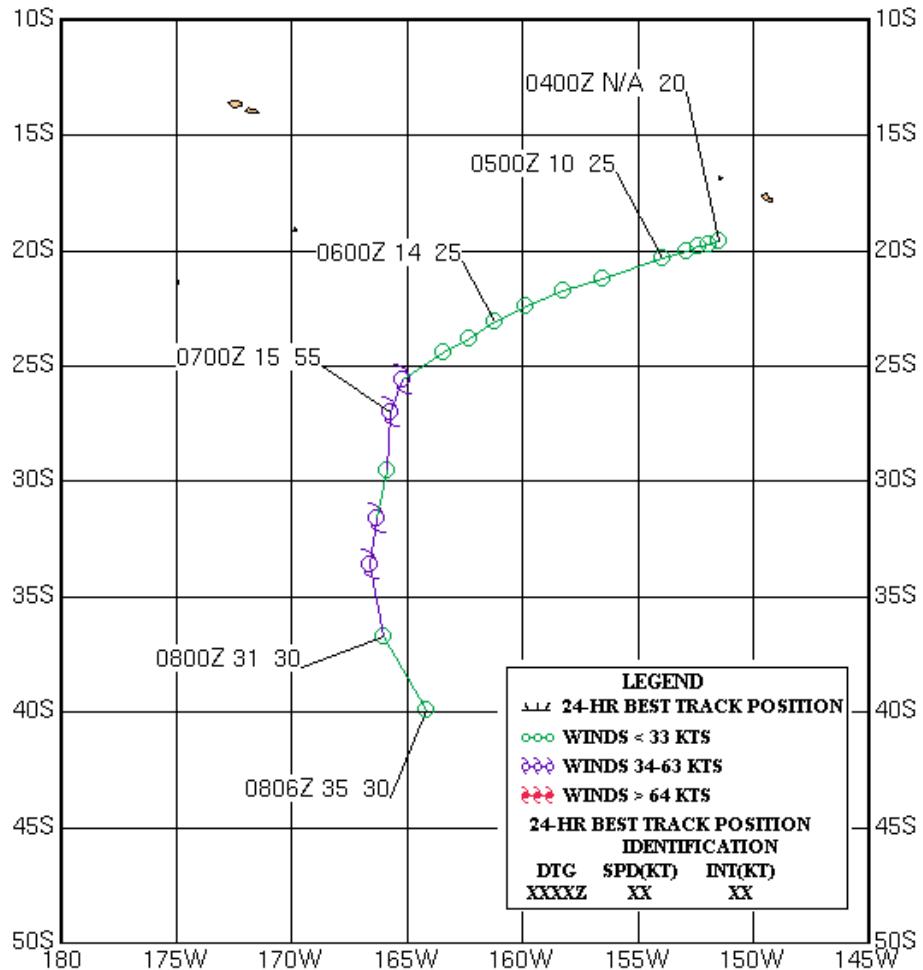


Figure 2-18P-1. 070843Z March 2000 85 GHz SSMI image of TC 18P, located in the South Pacific Ocean east of the Kermadec Islands. At this time, the cyclone is near peak intensity, with deep convection on the southern side of the low-level circulation center.

TROPICAL CYCLONE 18P (LEO)  
04 - 08 MARCH 2000



## **Tropical Cyclone (TC) 19P (Mona\*)**

First Poor : No Advisory east of 180 degrees

First Fair : No Advisory east of 180 degrees

First TCFA : 2351Z 07 Mar 00

First Warning : 0000Z 08 Mar 00

Last Warning : 0600Z 11 Mar 00

Max Intensity : 80 kts, Gusts to 100 kts

Landfall : None

Total Warnings : 8

Remarks : None

\* Name assigned by RSMC Nadi

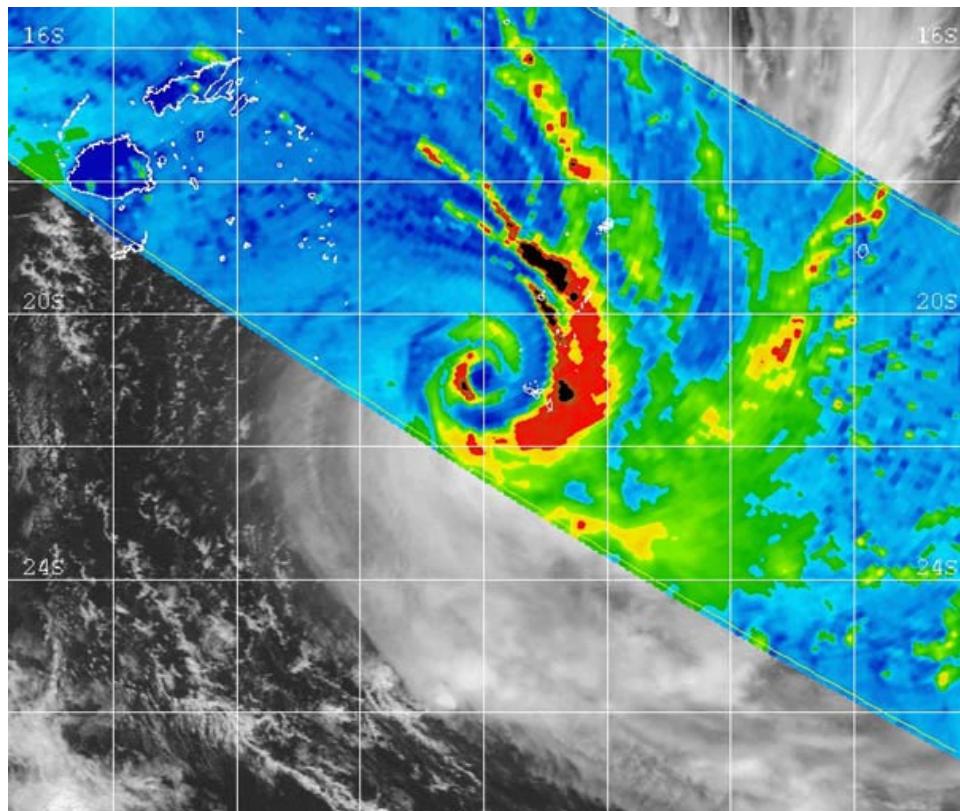


Figure 2-19P-1. 090053Z March 2000 TRMM 85GHz image of TC 19P, located just west of Tonga, with the eyewall open to the east and a large rainband located about 60 nm east of the circulation center.

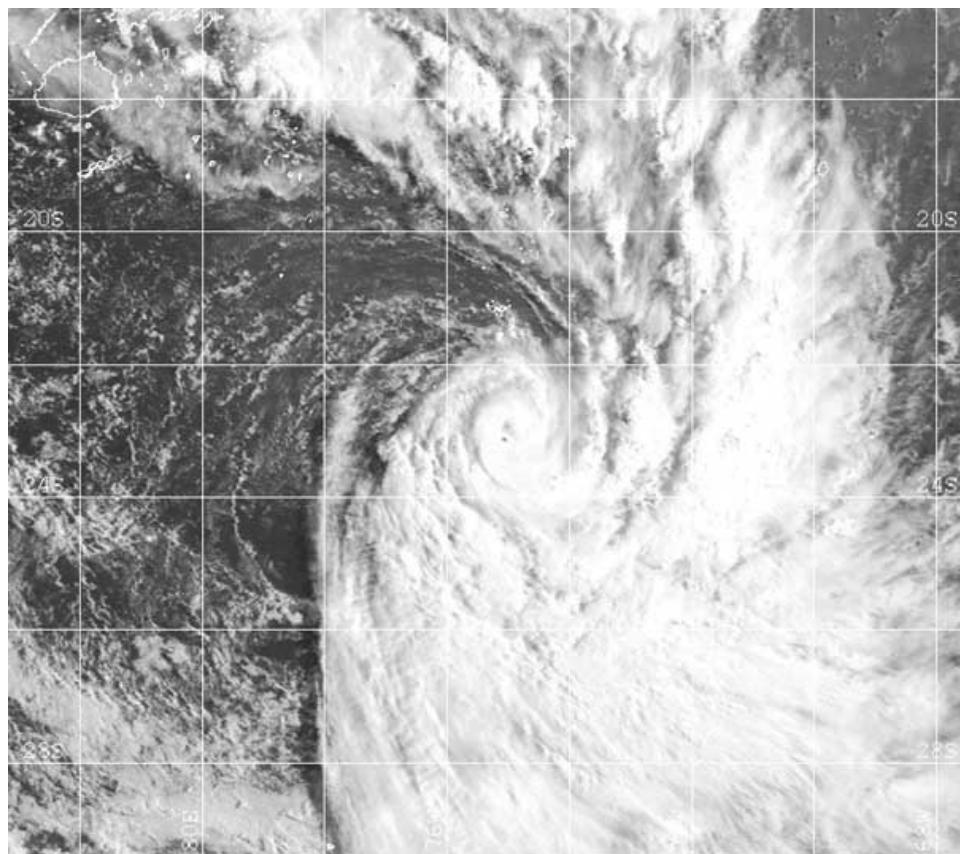
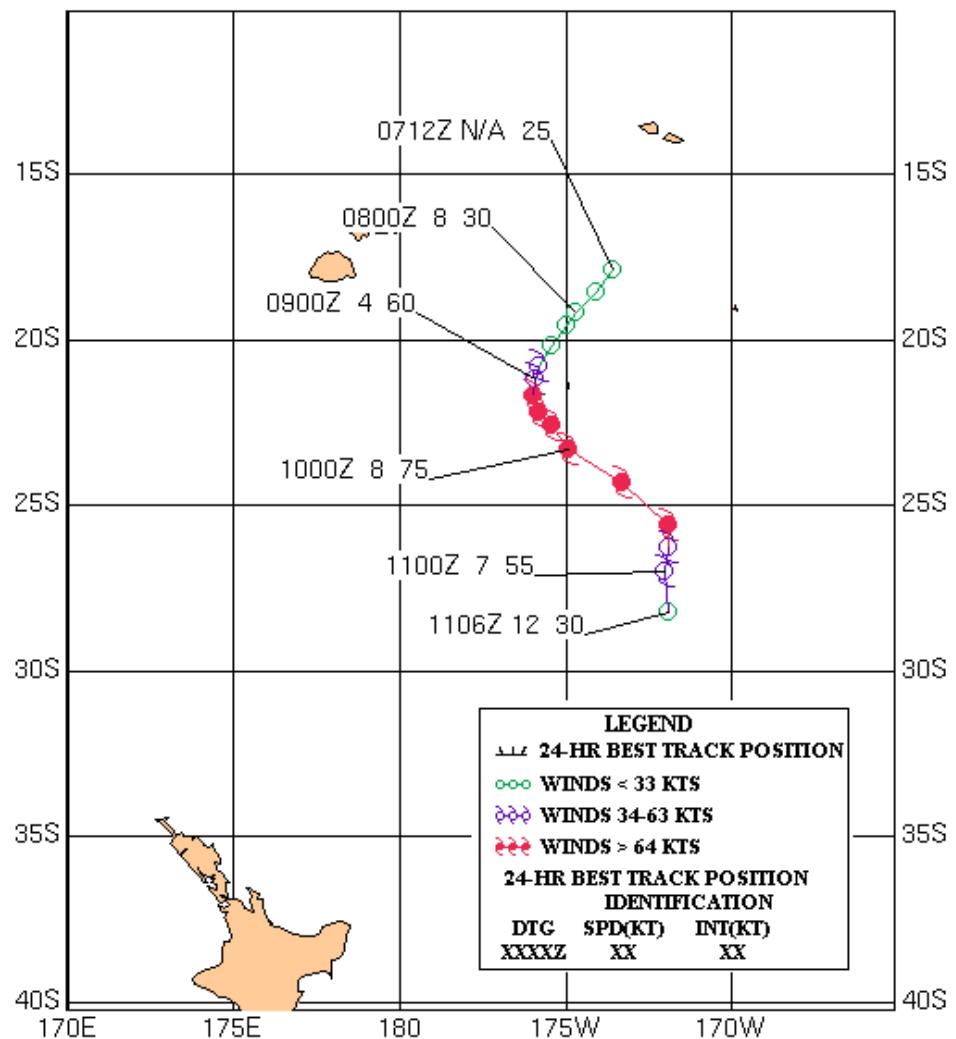


Figure 2-19P-2. 0919Z March 2000 visible image of TC 19P near peak intensity, located about 120 nm south of Tonga, with indication of westerly to northwesterly vertical shear.

TROPICAL CYCLONE 19P (MONA)  
07 - 11 MARCH 2000



## **Tropical Cyclone (TC) 20S (Olga\*)**

First Poor : 0200Z 14 Mar 00

First Fair : 0100Z 15 Mar 00

First TCFA : 0830Z 15 Mar 00

First Warning : 1200Z 15 Mar 00

Last Warning : 0000Z 19 Mar 00

Max Intensity : 50 kts, Gusts to 65 kts

Landfall : None

Total Warnings : 8

Remarks : None

\* Name assigned by Perth TCWC

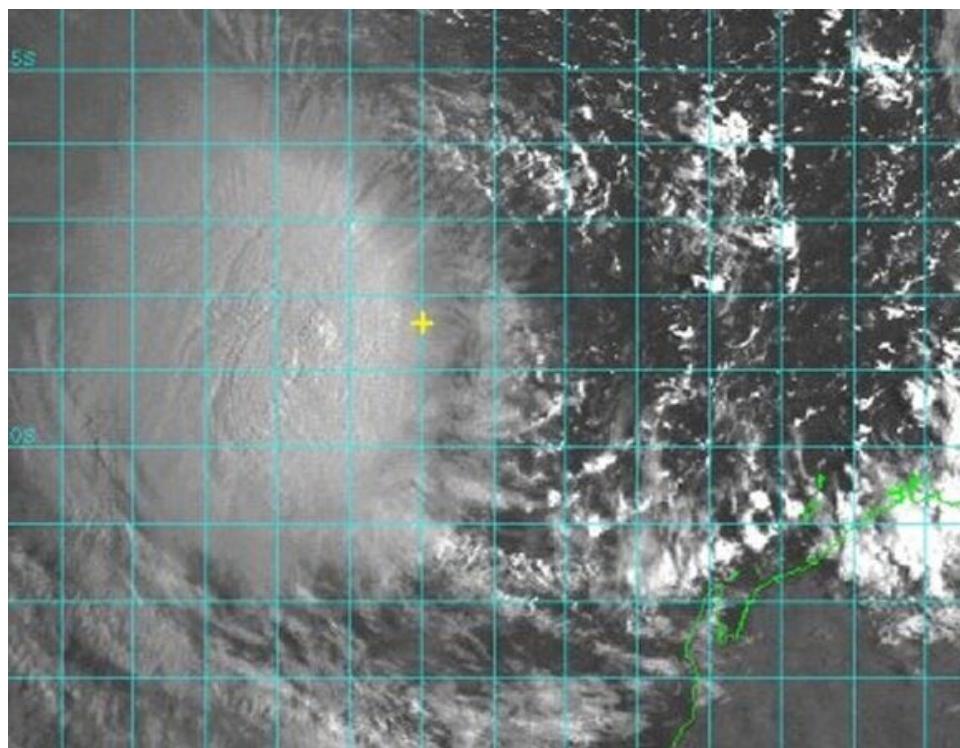
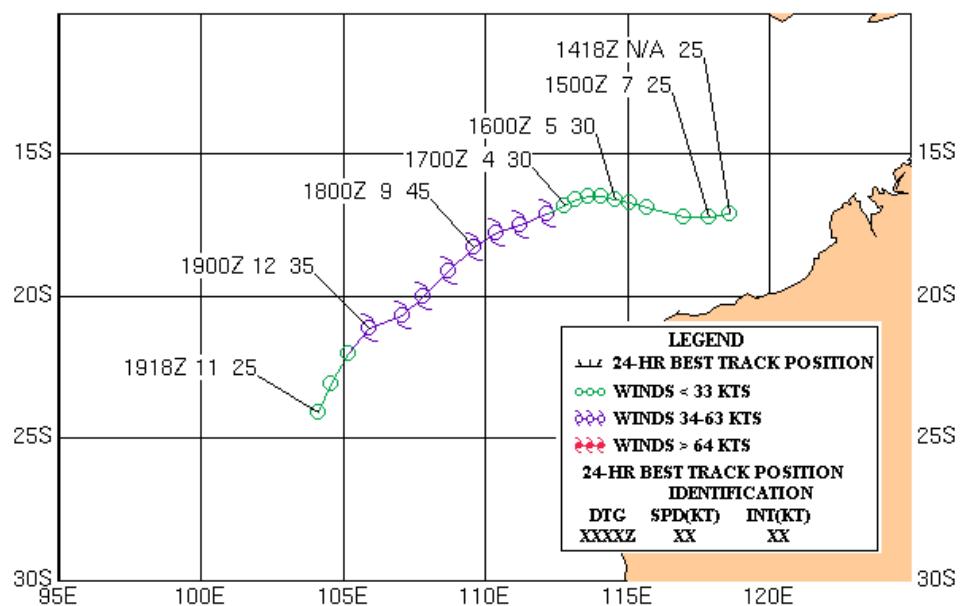


Figure 2-20S-1. 172330Z March 2000 visible satellite image of TC 20S, with a partially exposed low-level circulation center, when the cyclone had an estimated intensity of 45 knots.

TROPICAL CYCLONE 20S (OLGA)  
15 - 19 MARCH 2000



## **Tropical Cyclone (TC) 21S (Hudah\*)**

First Poor : 1800Z 22 Mar 00

First Fair : 0300Z 23 Mar 00

First TCFA : 0030Z 24 Mar 00

First Warning : 1200Z 24 Mar 00

Last Warning : 0600Z 09 Apr 00

Max Intensity : 125 kts, Gusts to 150 kts

Landfall : 1730Z 02 Apr 00 over Madagascar; 0600Z 08 Apr 00 over Mozambique

Total Warnings : 40

Remarks:

- (1) TC 21S had sustained winds of 120 kts when the cyclone made landfall over Madagascar.
- (2) Officials at the Madagascar National Relief Committee reported 27 fatalities, 100,000 homeless, and nearly every building in the northeastern city of Antalaha destroyed.
- (3) TC 21S made landfall in Mozambique with sustained winds from 80 and 90 kts.

\* Name assigned by RSMC La Reunion

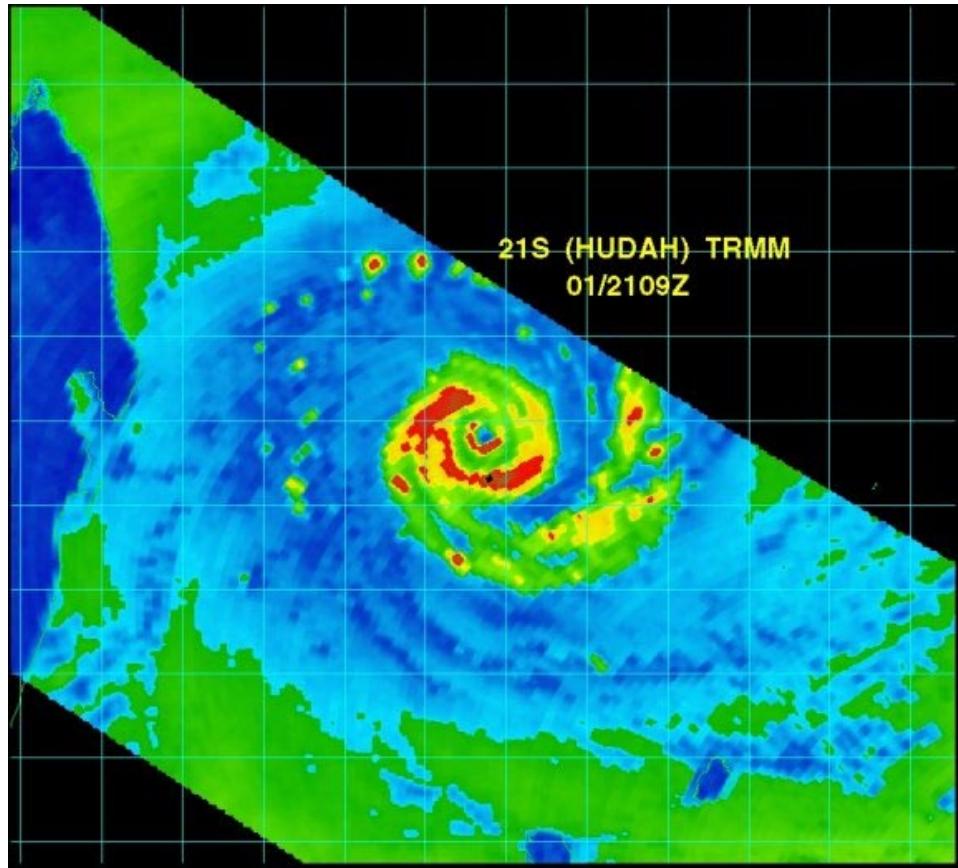
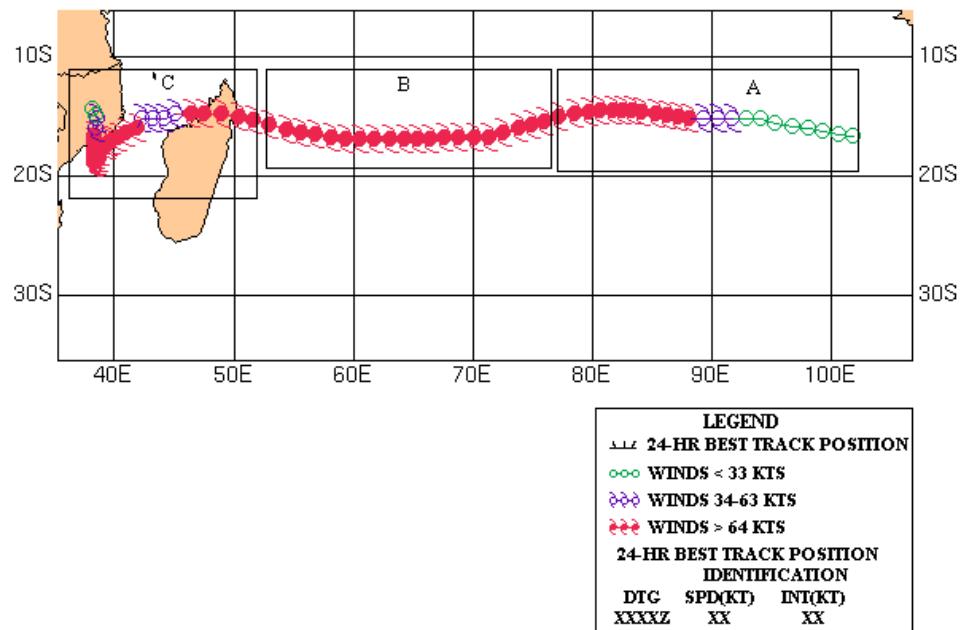
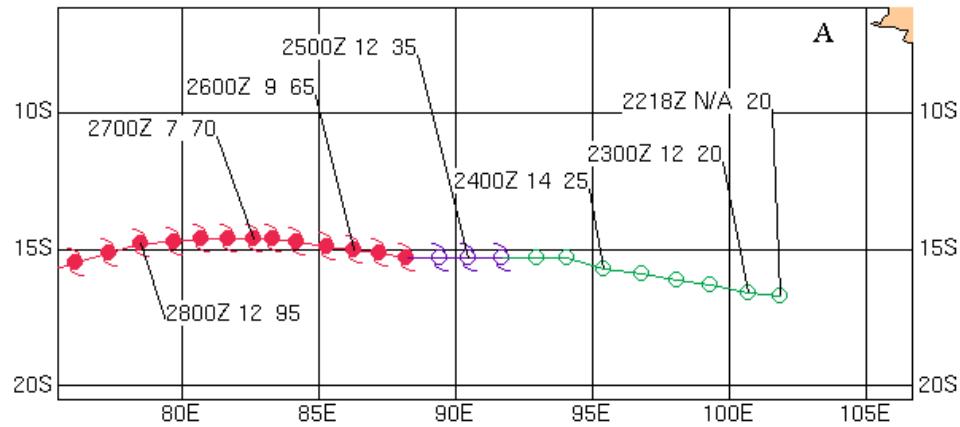


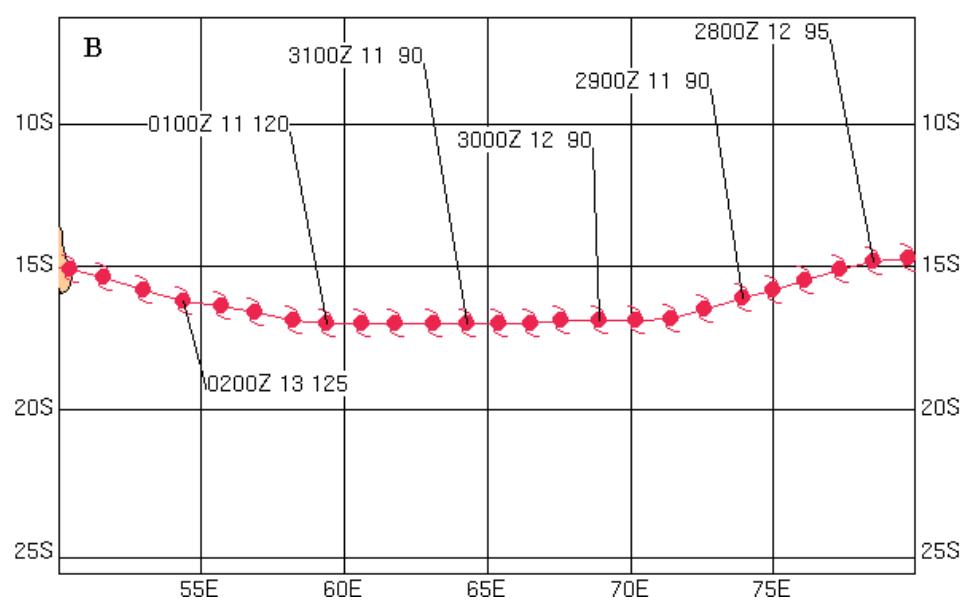
Figure 2-21S-1. 012109Z April TRMM 85 GHz image of TC 21S, when the cyclone was approximately 250 nm east of Madagascar, with estimated best track winds of 125 kts and a 20 nm eye within concentric eyewalls.

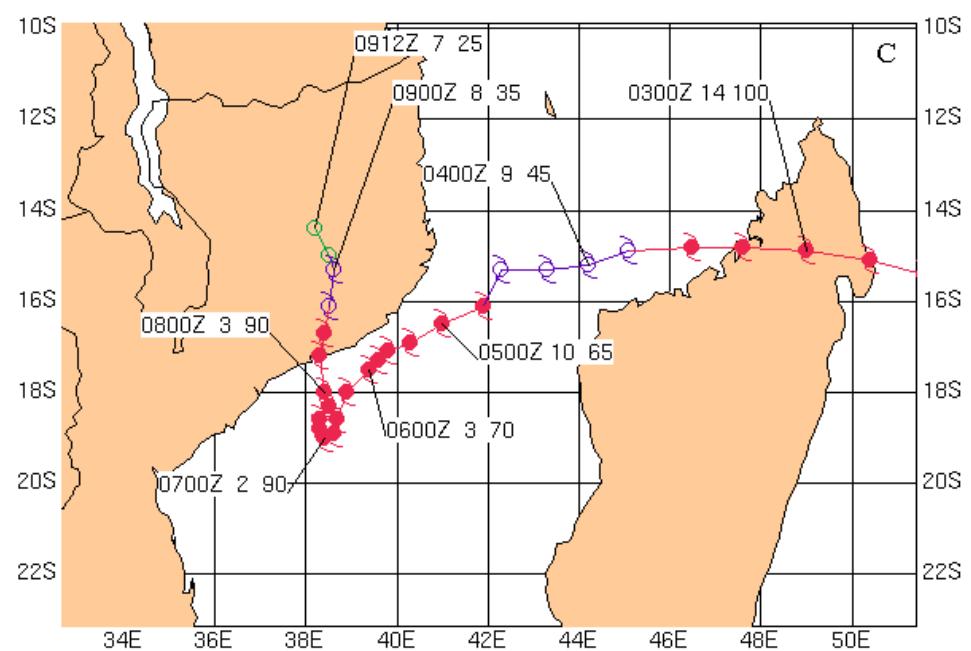
TROPICAL CYCLONE 21S (HUDAH)  
24 MARCH - 09 APRIL 2000



See below to view insets "A", "B", and "C" detail







# **Tropical Cyclone (TC) 22P (Tessi\*)**

First Poor : None

First Fair : 0600Z 31 Mar 00

First TCFA : 1500Z 31 Mar 00

First Warning : 0000Z 01 Apr 00

Last Warning : 0000Z 03 Apr 00

Max Intensity : 50 kts, Gusts to 65 kts

Landfall : 1900Z 03 Apr 00 near Lucinda, Australia

Total Warnings : 5

Remarks : None

\* Name assigned by Brisbane TCWC

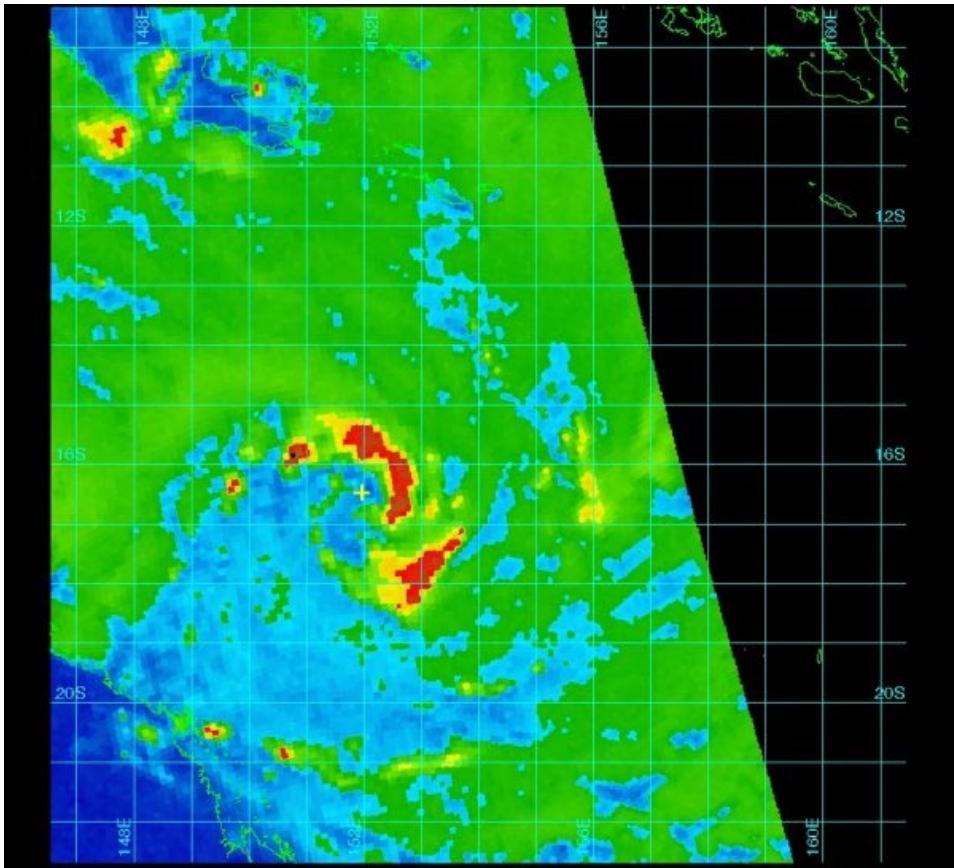


Figure 2-22P-1. 011126Z April 2000 SSMI 85 GHz of TC 22P, located east of Cape York Peninsula, Australia, with an estimated intensity of 40 knots. At this time, convective bands are confined to the northern and eastern portions of the system.

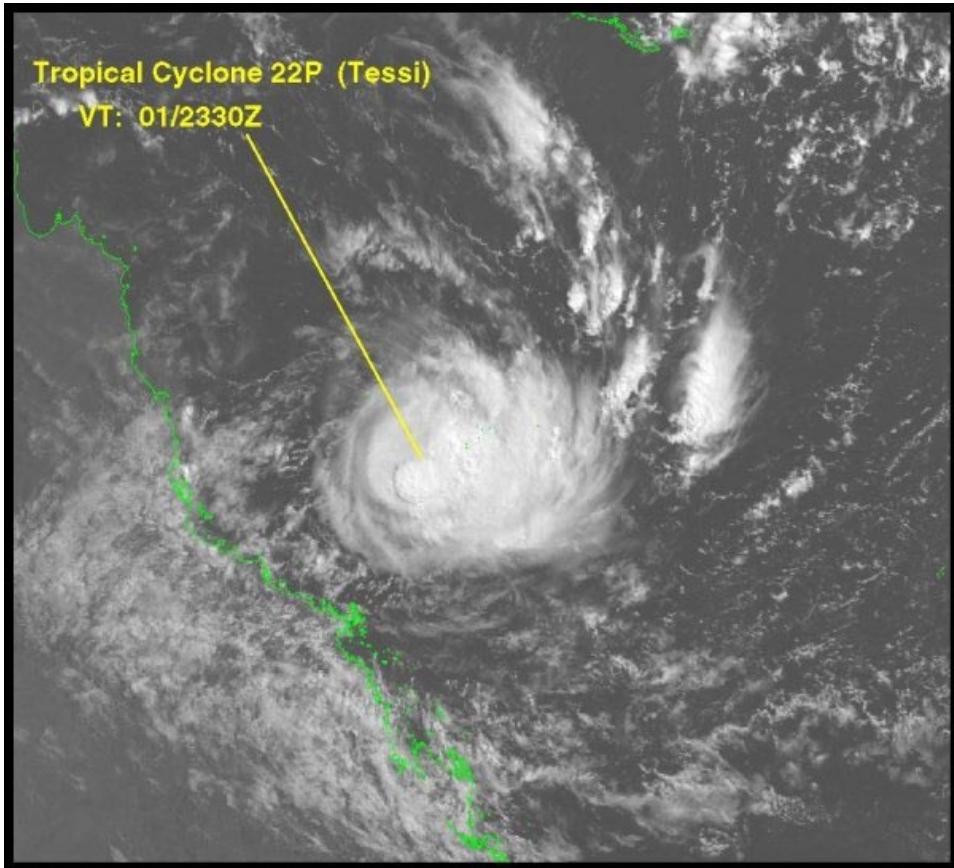
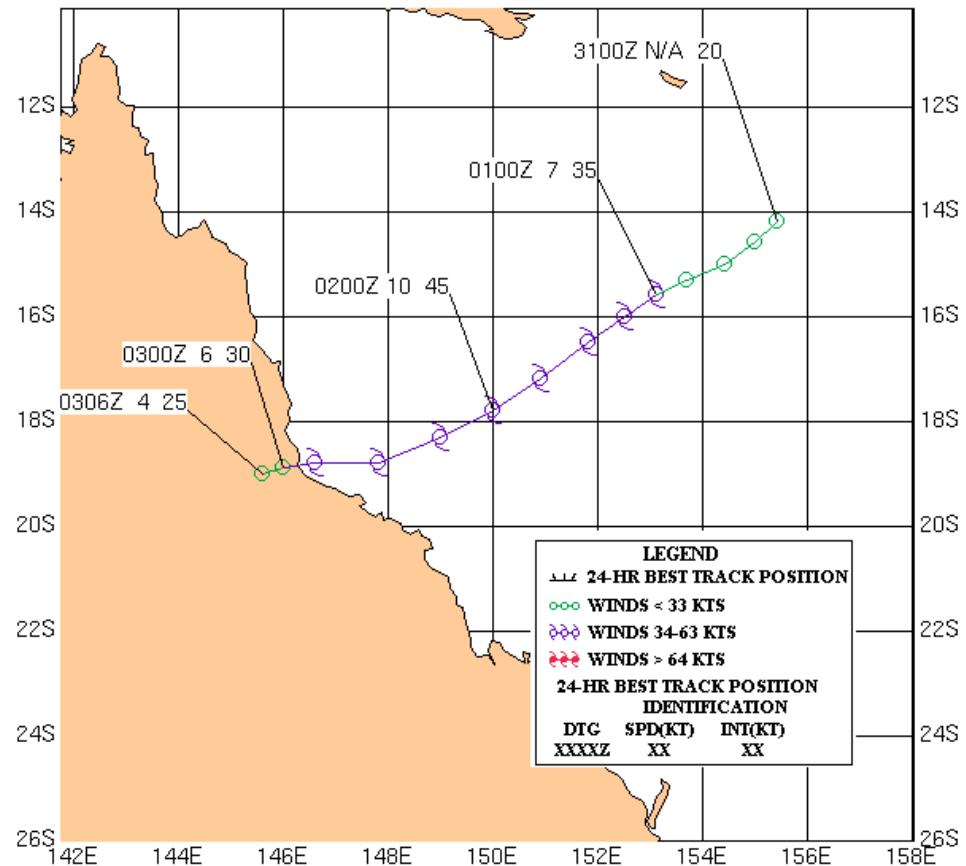


Figure 2-22P-2. A 012330Z April 2000 visible satellite image of TC 22P. Estimated intensity at this time is 45 knots.

TROPICAL CYCLONE 22P (TESSI)  
01 - 03 APRIL 2000



## **Tropical Cyclone (TC) 23P (Vaughan\*)**

First Poor : None

First Fair : 1830Z 02 Apr 00

First TCFA : 1930Z 02 Apr 00

First Warning : 0000Z 03 Apr 00

Last Warning : 0000Z 07 Apr 00

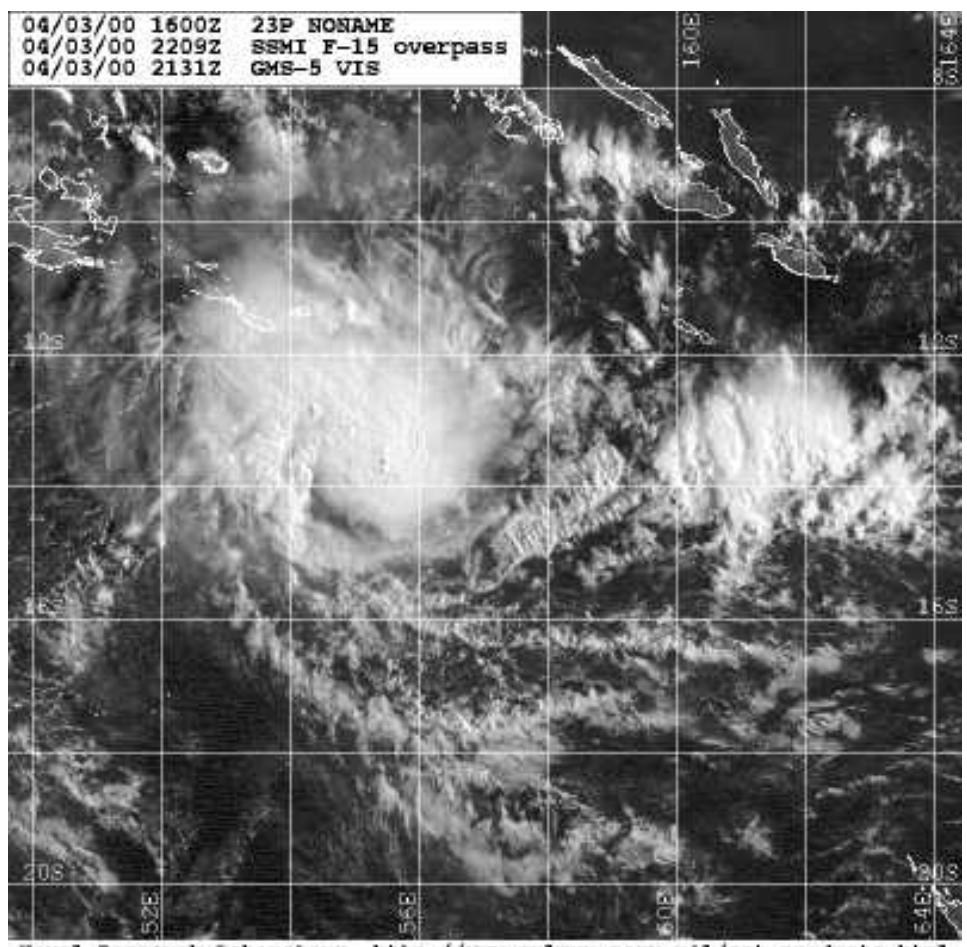
Max Intensity : 50 kts, Gusts to 65 kts

Landfall : 1800Z 06 Apr 00 near Cairns, Australia

Total Warnings : 9

Remarks : None

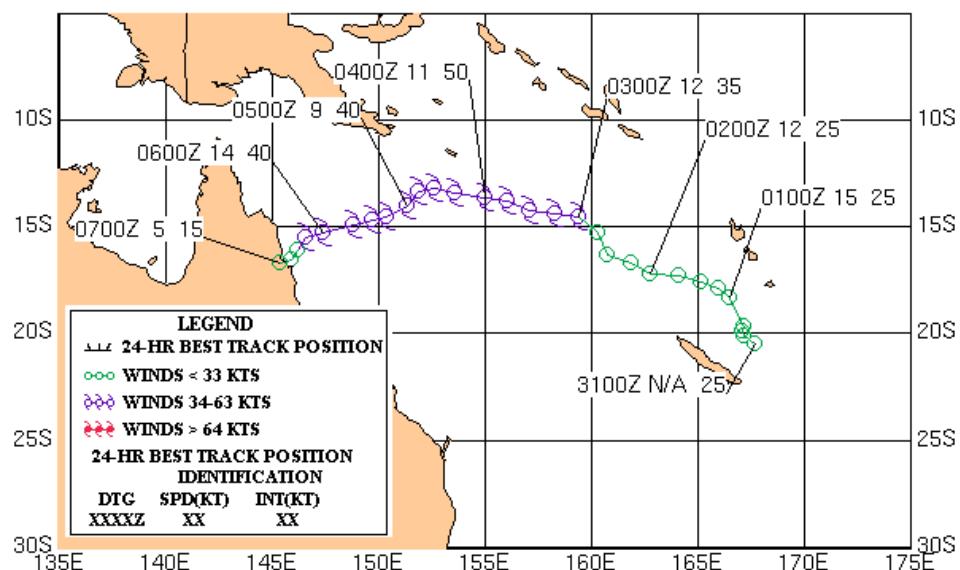
\* Name assigned by Brisbane TCWC



Naval Research Laboratory [http://www.nrlmry.navy.mil/sat\\_products.html](http://www.nrlmry.navy.mil/sat_products.html)

Figure 2-23P-1. 032215Z May 2000 GMS-5 visible image of TC 23P, located in the northern Coral Sea just before peak intensity.

TROPICAL CYCLONE 23P (VAUGHAN)  
03 - 07 APRIL 2000



## **Tropical Cyclone (TC) 24S (Paul\*)**

First Poor : 1800Z 10 Apr 00

First Fair : 0300Z 12 Apr 00

First TCFA : 1730Z 12 Apr 00

First Warning : 0000Z 13 Apr 00

Last Warning : 1200Z 21 Apr 00

Max Intensity : 130 kts, Gusts to 160 kts

Landfall : None

Total Warnings : 18

Remarks : None

\* Name assigned by Perth TCWC

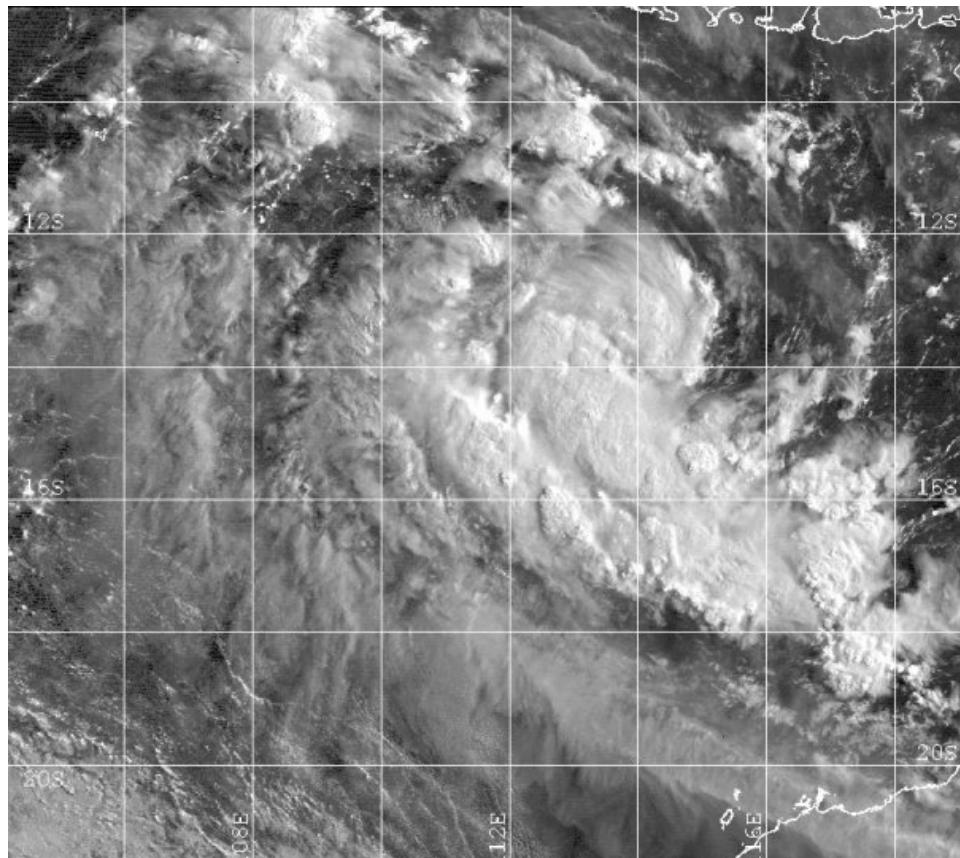


Figure 2-24S-1. 130029Z April 2000 visible image of TC 24S, located about 360 nm from the northwest coast of Australia, with a large area of convection near the low-level circulation center.

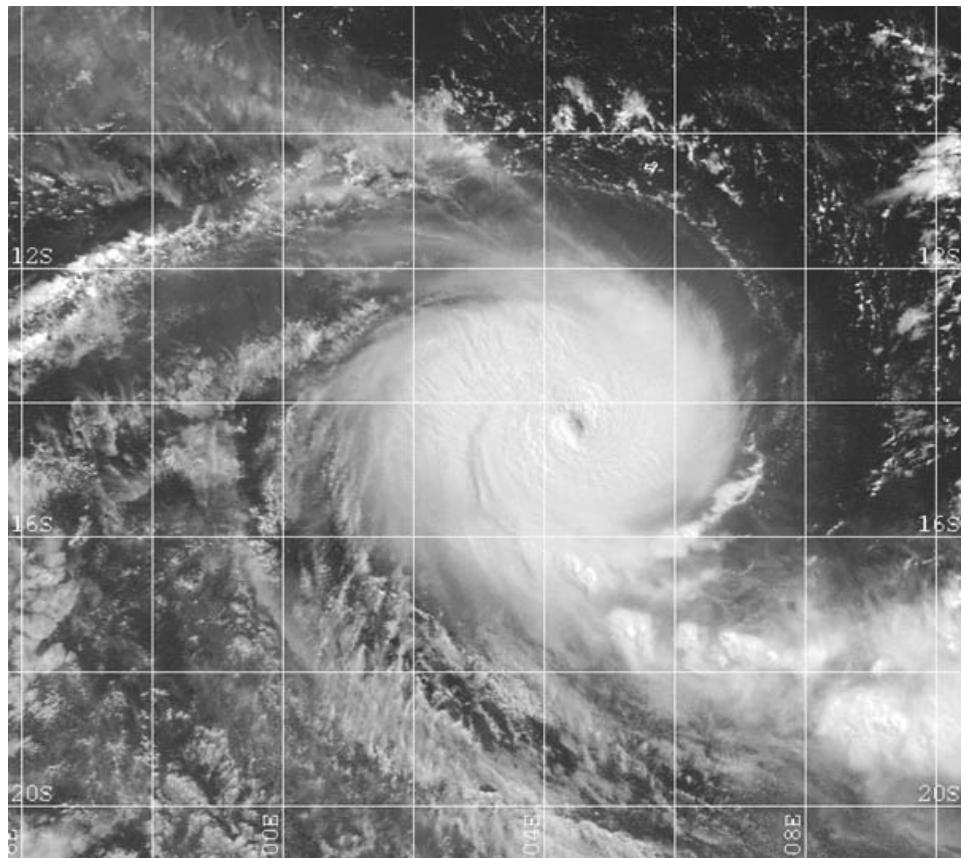


Figure 2-24S-2. 150131Z April 2000 visible image of TC 24S, located approximately 500 nm south of Sumatra near peak intensity. A well developed eye, with a central dense overcast, is evident.

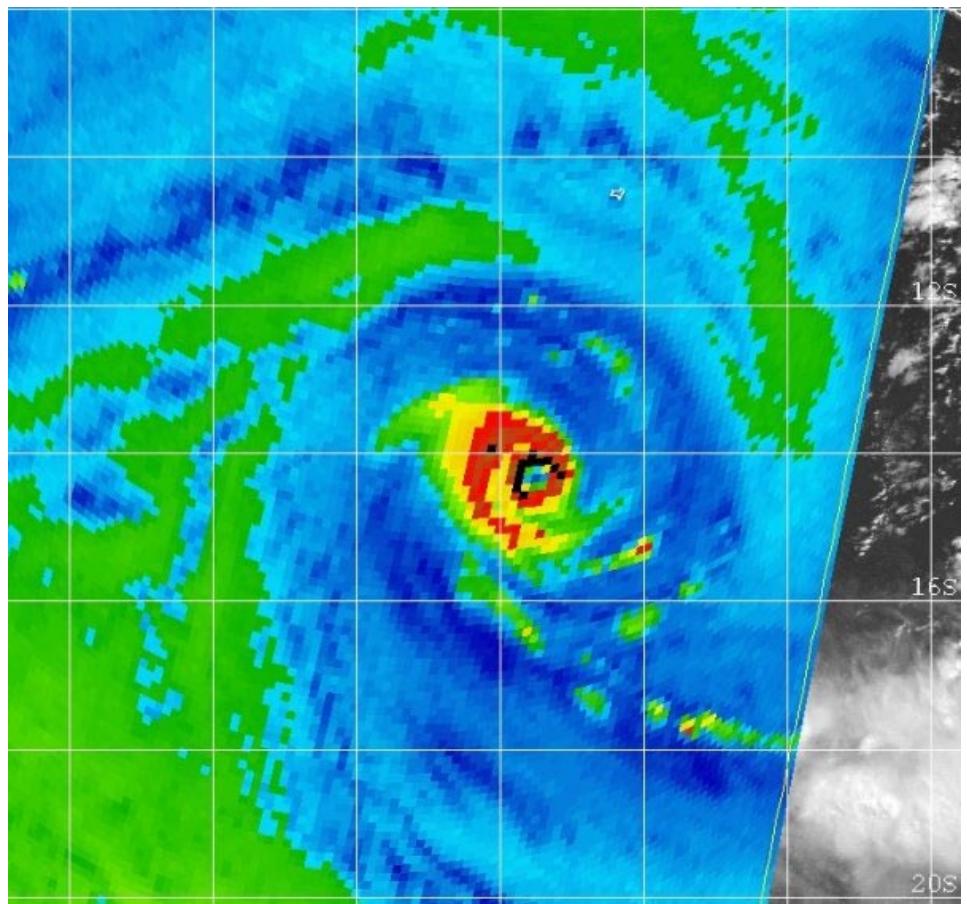


Figure 2-24s-3. 1500Z April 2000 SSMI 85 GHz image of TC 24S, with a well defined eye and a developed rainband west of the circulation center.

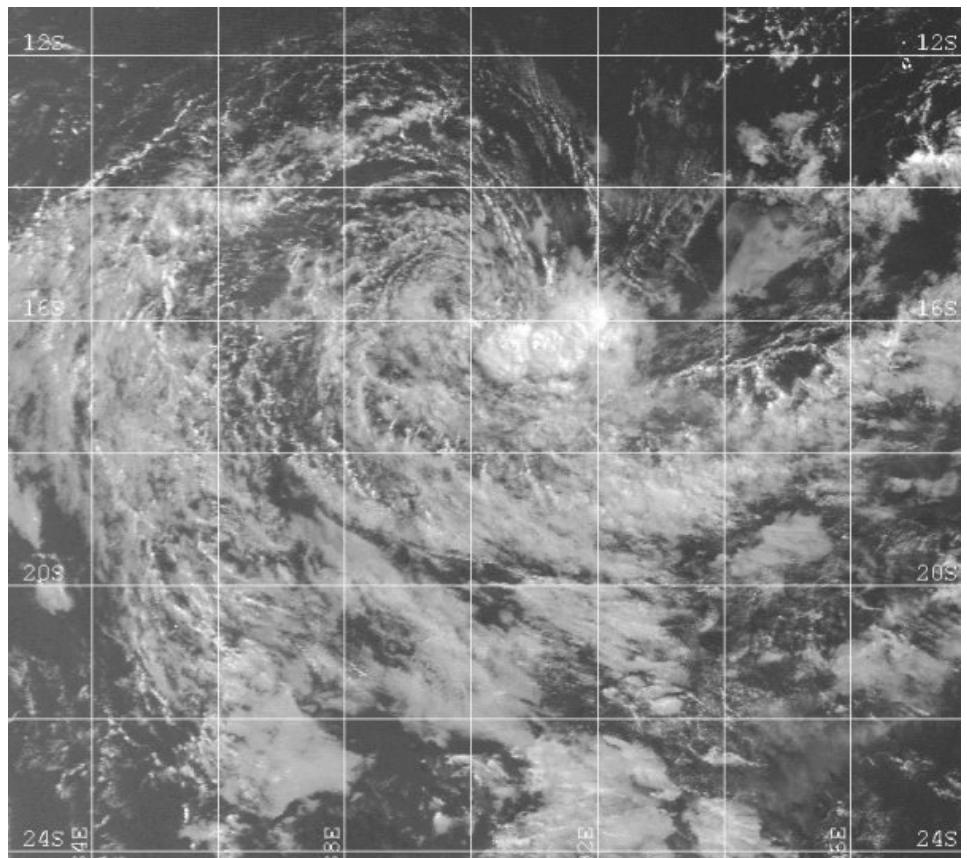
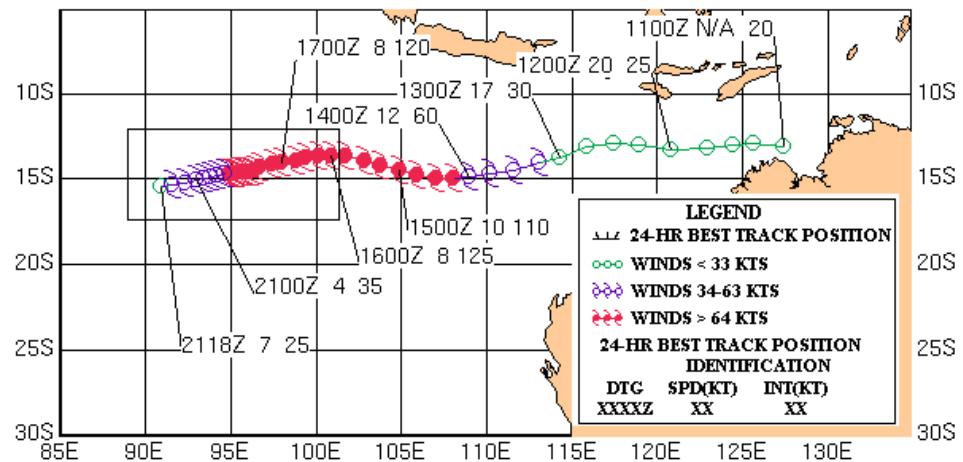
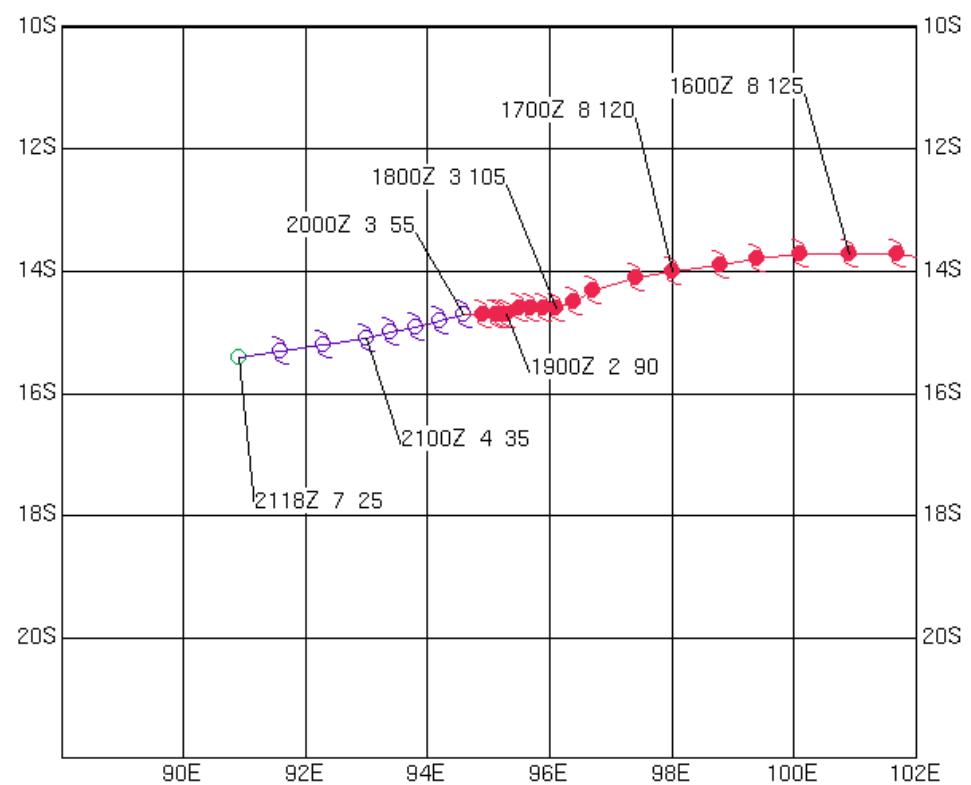


Figure 2-24S-4. 220148Z April 2000 visible image of TC 24S, with a completely exposed low-level circulation center and deep convection about 60 nm to the southeast.

TROPICAL CYCLONE 24S (PAUL)  
13 - 21 APRIL 2000



See below to view inset detail



## **Tropical Cyclone (TC) 25P (Neil\*)**

First Poor : 0600Z 14 Apr 00

First Fair : 1930Z 14 Apr 00

First TCFA : 0730Z 15 Apr 00

First Warning : 1200Z 15 Apr 00

Last Warning : 0000Z 17 Apr 00

Max Intensity : 40 kts, Gusts to 50 kts

Landfall : None

Total Warnings : 7

Remarks : None

\* Name assigned by RSMC Nadi

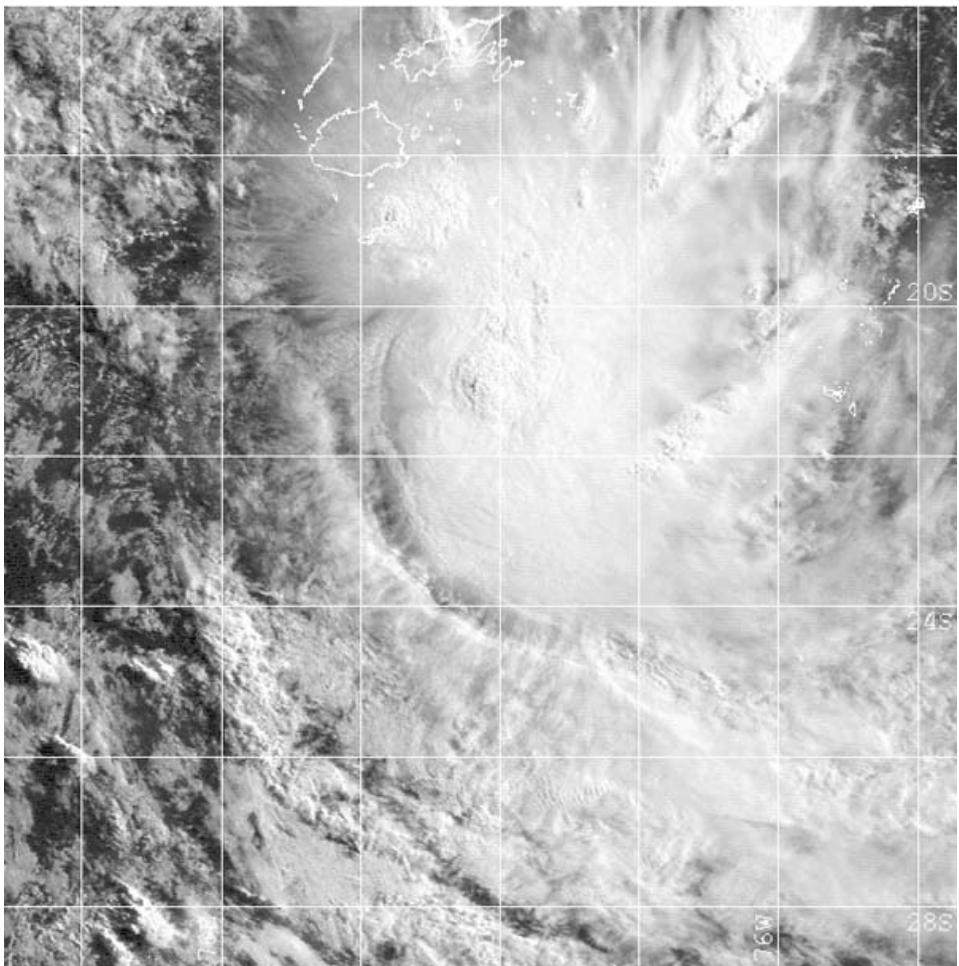
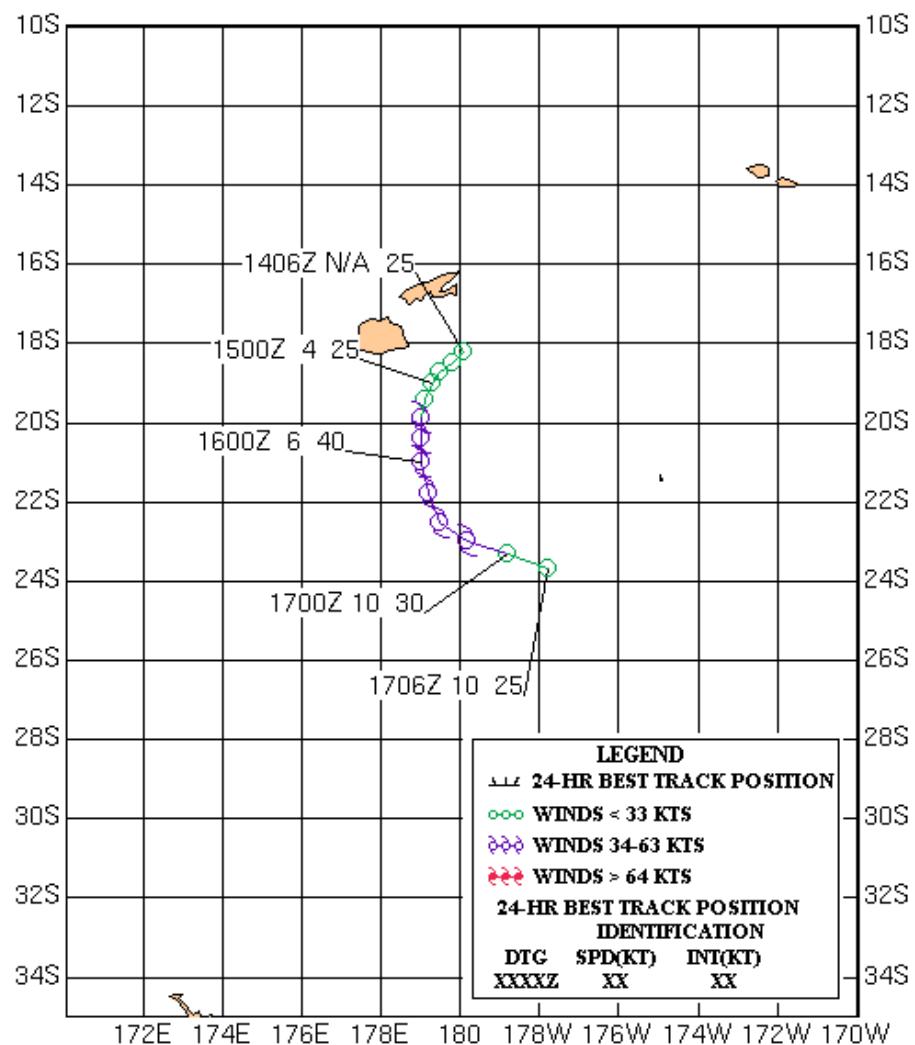


Figure 2-25P-1. 1519Z April 2000 visible satellite image of TC 25P, located about 120 nm south-southeast of Fiji with extensive deep convection around the circulation center.

TROPICAL CYCLONE 25P (NEIL)  
15 - 17 APRIL 2000



## **Tropical Cyclone (TC) 26S (Innocente\*)**

First Poor : 1800Z 08 Apr 00

First Fair : 0800Z 13 Apr 00

First TCFA : 1000Z 15 Apr 00

First Warning : 1800Z 15 Apr 00

Last Warning : 0600Z 19 Apr 00

Max Intensity : 45 kts, Gusts to 55 kts

Landfall : None

Total Warnings : 8

Remarks : None

\* Name assigned by RSMC La Reunion

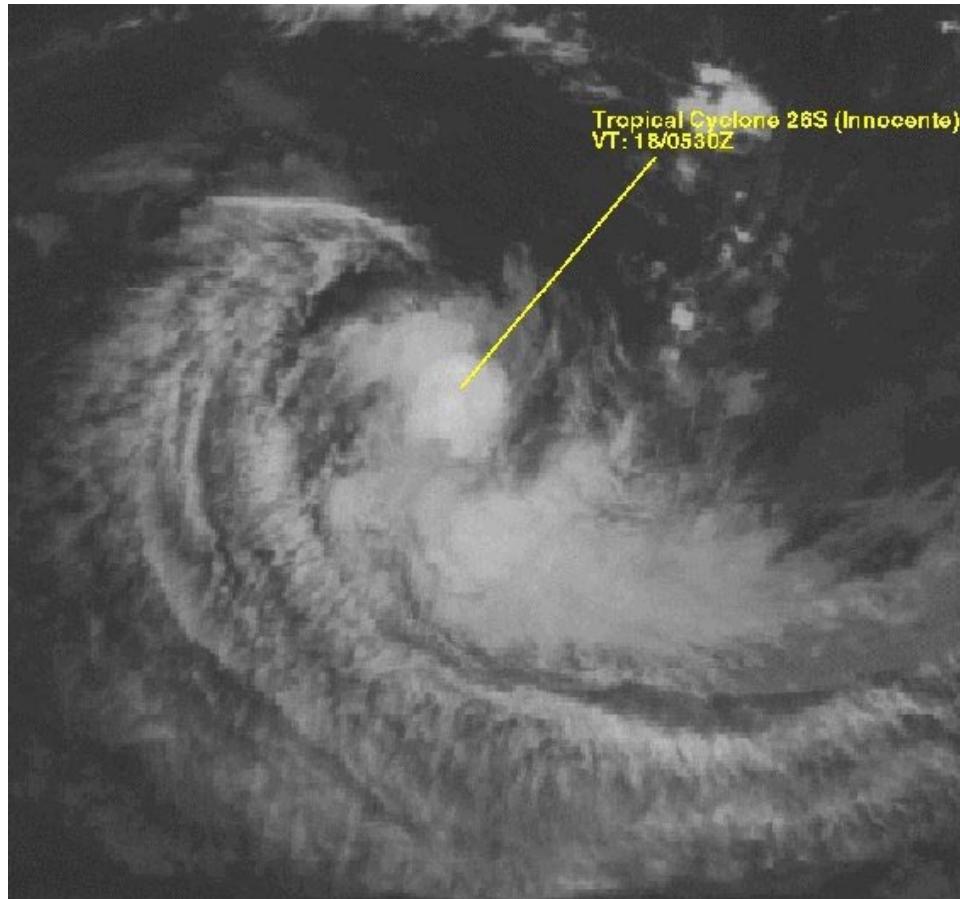
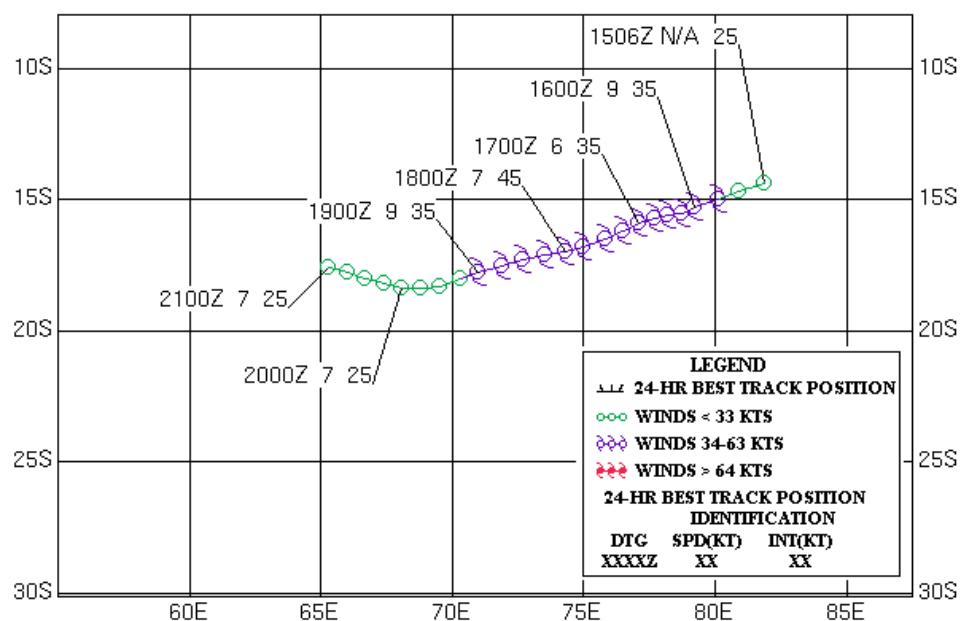


Figure 2-26S-1. 180530Z April 2000 infrared satellite image of TC 26S, located south of Diego Garcia with an estimated intensity of 45 knots. At this time, there is a central dense overcast with northeasterly vertical shear evident.

TROPICAL CYCLONE 26S (INNOCENTE)  
15 - 19 APRIL 2000



## **Tropical Cyclone (TC) 27S (Rosita\*)**

First Poor : 1800Z 15 Apr 00

First Fair : 2200Z 15 Apr 00

First TCFA : 0030Z 17 Apr 00

First Warning : 0600Z 17 Apr 00

Last Warning : 0600Z 20 Apr 00

Max Intensity : 125 kts, Gusts to 150 kts

Landfall : 1600Z 19 Apr 00 south of Broome, Australia

Total Warnings : 7

Remarks : None

\* Name assigned by Perth TCWC

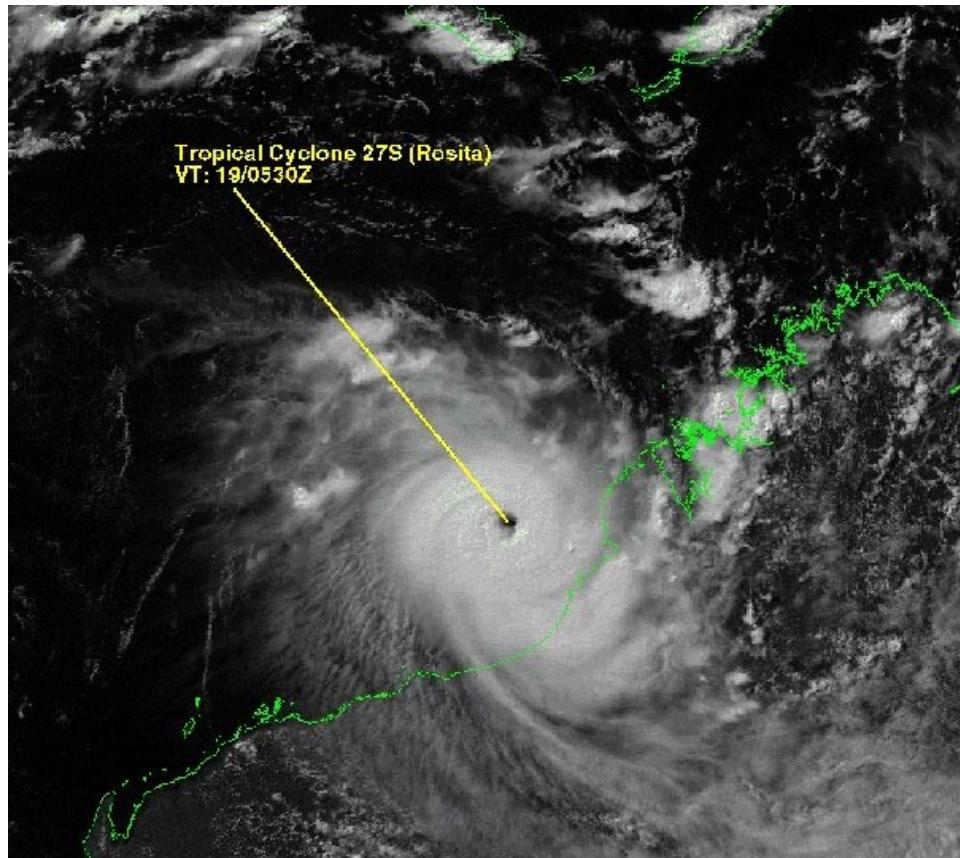
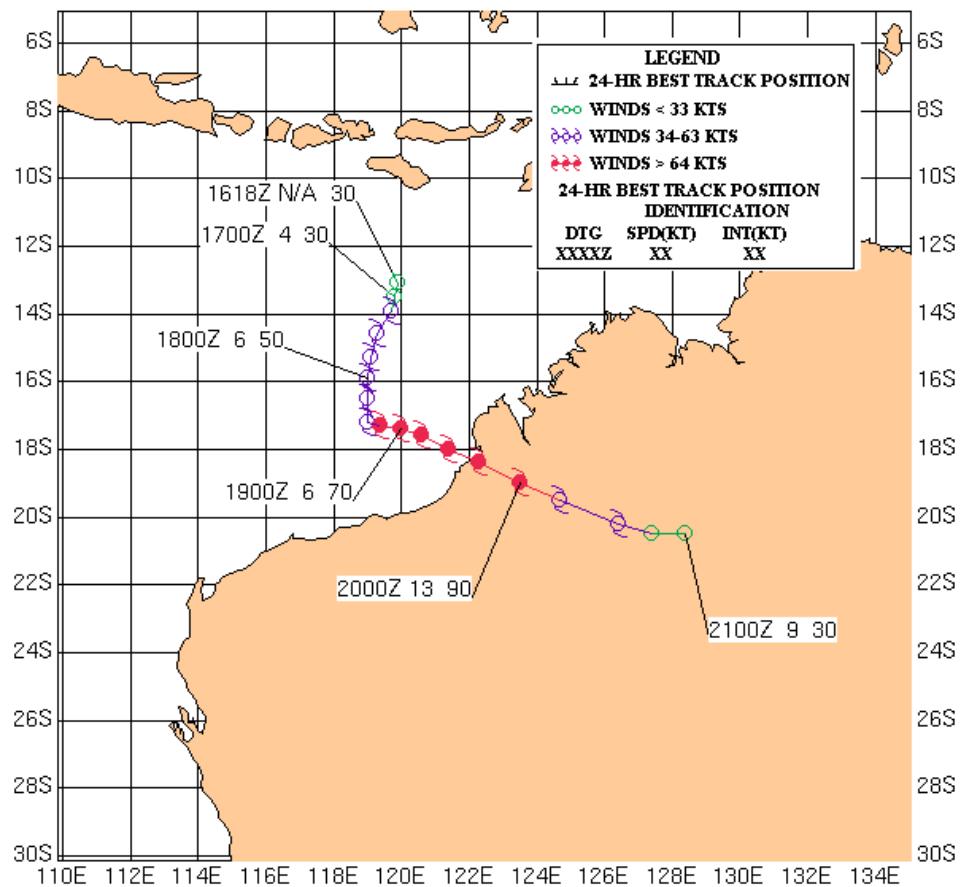


Figure 2-27S-1. 190530Z April 2000 visible satellite image of TC 27S, located west of the Kimberly region of Western Australia with an estimated intensity of 90 knots and a 14 nm diameter eye.

TROPICAL CYCLONE 27S (ROSITA)  
17 - 20 APRIL 2000



### 3. TROPICAL CYCLONE FIX DATA

#### 3.1 2000 SEASON

Tables 3-1 to 3-3 list the number of tropical cyclone center "fixes", or locations, made using satellite (visible, infrared, and microwave), scatterometer, radar, and synoptic data. Fixes made by the DOD tropical cyclone reconnaissance network sites are included in the tables as well as those fixes received from other sources (e.g., Japanese Meteorological Agency, Australian Bureau of Meteorology, and U.S. National Weather Service National Environmental Satellite Data and Information Service).

TABLE 3-1 SOUTH PACIFIC SOUTH INDIAN OCEAN FIX SUMMARY FOR 2000

Tropical Cyclone	Satellite	Scatt	Radar	Synoptic	Total
01S	Ilsa	142	3	0	148
02S	John	120	2	0	124
03S	Astride	197	8	0	205
04S	Babiola	166	10	0	176
05P	Iris	82	2	0	84
06S	-	80	3	0	85
07P	Jo	110	7	0	117
08S	Connie	195	6	0	201
09S	Kirrily	170	6	0	176
10S	Damiennie	69	0	0	69
11S	Leon-Eline	463	9	0	472
12S	Felicia	86	0	0	86
13P	Kim	134	5	0	139
14P	Steve	231	0	3	244
15S	Gloria	109	2	0	111
16S	Norman	165	4	0	169
17S	-	99	3	0	102
18P	Leo	75	0	0	75
19P	Mona	98	2	0	100
20S	Olga	86	3	0	89
21S	Hudah	384	7	0	391
22P	Tessi	58	0	0	60
23P	Vaughan	127	2	0	130
24S	Paul	219	2	0	221
25P	Neil	67	0	0	67
26S	Innocente	125	5	0	130
27S	Rosita	97	2	0	99
Totals	3954	93	3	20	4070

TABLE 3-1 SOUTH PACIFIC SOUTH INDIAN OCEAN FIX SUMMARY FOR 2000

Percentage of Total	97.1	2.3	0.1	0.5	100
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TABLE 3-2 WESTERN NORTH PACIFIC OCEAN FIX SUMMARY FOR 2000

Tropical Cyclone	Satellite	Scatt	Radar	Synoptic	Total
01W	Damrey	195	4	0	199
02W	Longwang	32	0	0	32
03W	-	12	0	0	12
04W	-	60	3	0	63
05W	Kirogi	150	4	0	154
06W	Kai-Tak	151	0	0	153
07W	-	60	4	0	66
08W	-	40	2	0	42
09W	Tembin	128	6	0	135
10W	-	47	1	0	48
11W	Bolaven	188	3	12	205
12W	Chanchu	50	2	0	52
13W	Jelewat	323	2	0	328
14W	-	54	0	0	54
15W	Ewiniar	262	6	0	268
16W	Wene	53	1	0	54
17W	-	19	0	0	19
18W	Bilis	187	3	0	190
19W	Kaemi	66	3	0	70
20W	Prapiroon	212	5	0	217
21W	Maria	105	1	0	106
22W	Saomai	369	14	45	428
23W	Wukong	153	2	0	155
24W	Bopha	149	3	1	153
25W	Sonamu	91	2	1	94
26W	Shanshan	208	4	0	212
27W	-	55	1	0	56
28W	-	136	6	0	147
29W	Yagi	195	1	71	267
30W	Xangsane	210	1	0	212
31W	Bebinca	224	1	0	226
32W	-	51	0	6	57
33W	Rumbia	213	2	0	218
34W	Soulik	197	3	0	200
Totals		4645	90	136	4892
Percentage of Total		95.0	1.8	2.8	100

TABLE 3-3 NORTHERN INDIAN OCEAN FIX SUMMARY FOR 2000

Tropical Cyclone	Satellite	Scatt	Radar	Synoptic	Total
01B	-	92	3	0	95
02B	-	57	0	0	57

TABLE 3-3 NORTHERN INDIAN OCEAN FIX SUMMARY FOR 2000

03B	-	219	0	0	0	219
04B	-	111	1	0	0	112
Totals		479	4	0	0	483
Percentage of Total		99.2	0.8	0	0	100

### 3.2 2000 Western North Pacific Satellite Fix Errors

Table 3-4 and Figures 3-1 to 3-4 depict 2000 western North Pacific fix errors (nm) of the Special Sensor Microwave Imager (SSMI), ERS-2 and SeaWinds Scatterometer (SCAT), Tropical Rainfall Measuring Mission (TRMM), and geostationary (VIS/IR) satellites based on Position Confidence Numbers (PCN) and tropical cyclone strengths.

TABLE 3-4 2000 Western North Pacific Satellite Fix Errors

Sensor	PCN	Average Fix Error (nm)	Cases
SSMI	1,2	10.97	81
	3,4	17.96	167
	5,6	24.35	216
SCAT	1,2	32.74	51
	3,4	27.18	29
	5,6	45.74	8
TRMM	1,2	9.3	12
	3,4	15.29	32
	5,6	18.00	25
VIS/IR	1,2	7.69	485
	3,4	15.00	928
	5,6	24.17	2602

This analysis highlights the fact that fixes increase in accuracy as the system intensifies from tropical depression strength to typhoon strength. For all cases (Figure 3-4), the VIS/IR fixes have the lowest errors in the PCN 1,2 and PCN 3,4 category. However, the TRMM sensor has the lowest errors in the PCN 5,6 category with VIS/IR having the second lowest errors. SSMI and SCAT have the third and fourth lowest errors respectively in all PCN categories.

### 3.3 1999 SEASON

Satellite fix information was inadvertently omitted from the 1999 Annual Tropical Cyclone Report, and is provided in this section. Table 3-5 represents the total fix numbers for all oceanic basins within the Joint Typhoon Warning Center's area of responsibility in 1999. Fixes made by the DOD tropical cyclone reconnaissance network sites are included in the tables as well as those fixes received from other sources (e.g. Japanese Meteorological Agency, Australian Bureau of Meteorology, and U.S. National Weather Service National Environmental Satellite Data and Information Service).

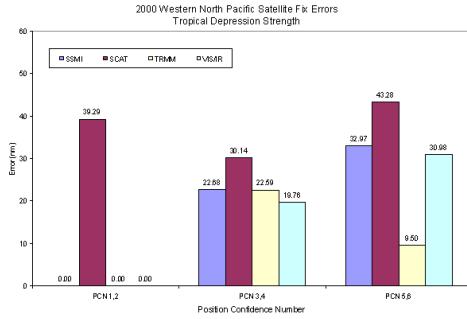


Figure 3-1. 2000 Western North Pacific fix errors (nm) of the Special Sensor Microwave Imager (SSMI), ERS-2 and SeaWinds Scatterometer (SCAT), Tropical Rainfall Measuring Mission (TRMM), and geostationary (VIS/IR) satellites based on Position Confidence Numbers (PCN) for tropical depression strength systems.

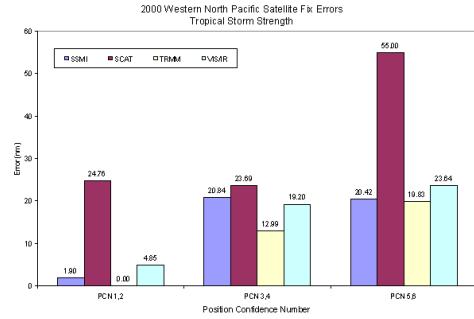


Figure 3-2. Same as in Fig. 3-1. except for tropical storm strength.

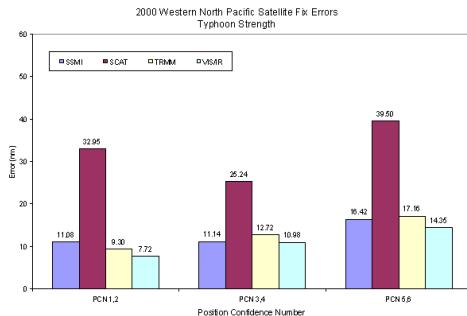


Figure 3-3. Same as in Fig. 3-1. except for typhoon strength systems.

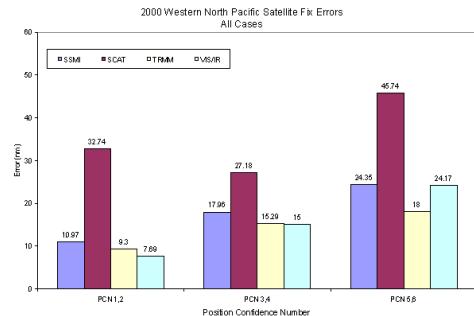


Figure 3-4. Same as in Fig. 3-1. except for systems of all strengths.

TABLE 3-5 FIXES BY OCEANIC BASIN FOR 1999

Oceanic Basin	Total Fixes
Northwest Pacific	2,952
Southern Hemisphere	3,056
Northern Indian Ocean	493
Total	6,501

## 4. SUMMARY OF FORECAST VERIFICATION

### 4.1 ANNUAL FORECAST VERIFICATION

Verification of warning positions and intensities at initial, 12-, 24-, 48-, and 72-hour forecast periods are made against the final best track. The (scalar) track forecast, along-track and cross-track errors (illustrated in Figure 4-1) were calculated for each verifying JTWC forecast. These data, in addition to a detailed summary for each tropical cyclone, are included as Chapter 4. This section summarizes verification data this year and contrasts it with annual verification statistics from previous years.

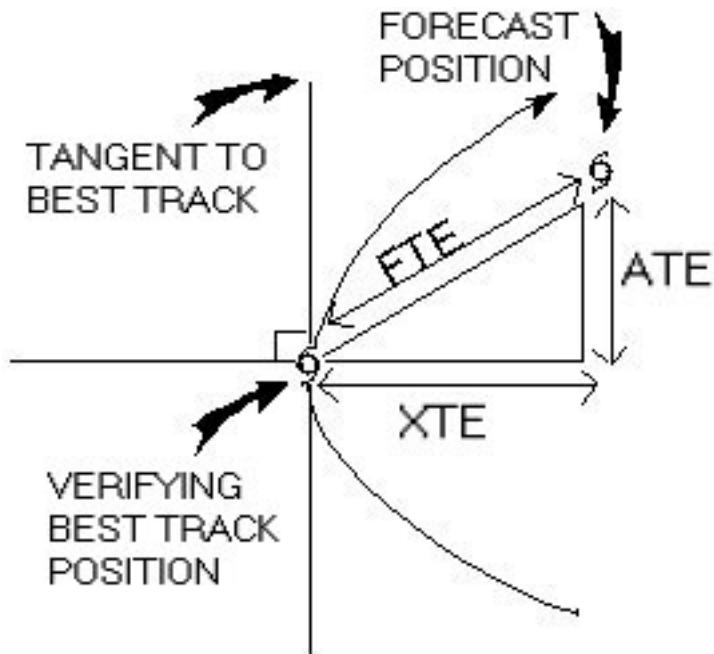


Figure 4-1. Definition of cross-track error (XTE), along-track error (ATE), and forecast track error (FTE). In this example, the forecast position is ahead of and to the right of the verifying best track position. Therefore, the XTE is positive (to the right of the best track) and the ATE is positive (ahead or faster than the best track). Adapted from Tsui and Miller, 1988.

## 4.1.1 WESTERN NORTH PACIFIC OCEAN

Table 4-1 includes mean track, along-track and cross-track errors from 1959, when JTWC was founded, until the present. Figure 4-2 shows mean track errors and a 5-year running mean of track errors at 24-, 48- and 72-hours since 1974.

Table 4-1 MEAN FORECAST TRACK ERRORS (NM) FOR WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959-2000

YEAR (Notes)	24-HOUR			48-HOUR			72-HOUR					
	TY (1)	TC (3)	CROSS TRACK (2)	ALONG TRACK (2)	TY (1)	TC (3)	CROSS TRACK (2)	ALONG TRACK (2)	TY (1)	TC (3)	CROSS TRACK (2)	ALONG TRACK (2)
1959	117*				267*							
1960	177*				354*							
1961	136				274							
1962	144				287				476			
1963	127				246				374			
1964	133				284				429			
1965	151				303				418			
1966	136				280				432			
1967	125				276				414			
1968	105				229				337			
1969	111				237				349			
1970	98	104			181	190			272	279		
1971	99	111	64		203	212	118		308	317	177	
1972	116	117	72		245	245	146		382	381	210	
1973	102	108	74		193	197	134		245	253	162	
1974	114	120	78		218	226	157		357	348	245	
1975	129	138	84		279	288	181		442	450	290	
1976	117	117	71		232	230	132		336	338	202	
1977	140	148	83		266	283	157		390	407	228	
1978	120	127	71	87	241	271	151	194	459	410	218	296
1979	113	124	76	81	219	226	138	146	319	316	182	214
1980	116	126	76	86	221	243	147	165	362	389	230	266
1981	117	124	77	80	215	221	131	146	342	334	219	206
1982	114	113	70	74	229	238	142	162	337	342	211	223
1983	110	117	73	76	247	260	164	169	384	407	263	259
1984	110	117	64	84	228	232	131	163	361	363	216	238
1985	112	117	68	80	228	231	138	153	355	367	227	230
1986	117	126	70	85	261	261	151	183	403	394	227	276
1987	101	107	64	71	211	204	127	134	318	303	186	198
1988	107	114	58	85	222	216	103	170	327	315	159	244
1989	107	120	69	83	214	231	127	162	325	350	177	265
1990	98	103	60	72	191	203	110	148	299	310	168	225
1991	93	96	53	69	187	185	97	137	298	287	146	229
1992	97	107	59	77	194	205	116	143	295	305	172	210
1993	102	112	63	79	205	212	117	151	320	321	173	226
1994**	96	105	56	76	172	186	105	131	244	258	152	176
1995	105	123	67	89	200	215	117	159	311	325	167	240
1996	85	105	56	76	157	178	89	134	252	272	137	203
1997	86	93	55	76	159	164	87	134	251	245	120	202

Table 4-1 MEAN FORECAST TRACK ERRORS (NM) FOR WESTERN NORTH PACIFIC TROPICAL CYCLONES FOR 1959-2000

1998	127	124	58	98	263	239	127	178	392	370	201	274
1999	88	106	59	74	150	176	102	119	225	234	139	155
2000	75	81	45	57	136	142	80	98	205	209	118	144
Averages (1978 - 2000)	104	112	64	79	207	215	122	151	321	323	183	226

1. Track errors were calculated for typhoons when intensities were at least 35kts at warning times

2. Cross-track and along-track errors were adopted by the JTWC in 1986. Right angle errors (used prior to 1986) were recomputed as cross-track errors after-the fact to extend the data base. See Figure 3-1 for the definitions of cross-track and along-track.

3. Mean forecast errors for all warned systems in Northwest Pacific.

\*Forecast positions north of 35 degrees North latitude were not verified.

\*\*1994 statistics were recalculated to resolve earlier Along and Cross-Track discrepancies.

## 4.1.2 NORTH INDIAN OCEAN

Table 4-2 includes mean track, along-track and cross-track errors for a 16-year period. Figure 4-3 shows mean track errors and a 5-year running mean of track errors at 24- and 48-hours since 1985, and at 72-hours since 1986.

Table 4-2 JTWC INITIAL POSITION AND FORECAST ERRORS (NM) FOR THE NORTH INDIAN OCEAN 1985-2000

Initial Position	24-Hour				48-Hour				72-Hour					
	Number	Error	Number	Track	Along	Cross	Number	Track	Along	Cross	Number	Track	Along	Cross
1985	53	31	30	122	102	53	8	242	119	194	0			
1986	28	52	16	134	118	53	7	168	131	80	5	269	189	180
1987	83	42	54	144	97	100	25	205	125	140	21	305	219	188
1988	44	34	30	120	89	63	18	219	112	176	12	409	227	303
1989	44	19	33	88	62	50	17	146	94	86	12	216	164	11
1990	46	31	36	101	85	43	24	146	117	67	17	185	130	104
1991	56	38	43	129	107	54	27	235	200	89	14	450	356	178
1992	191	35	149	128	73	86	100	244	141	166	62	398	276	218
1993	36	27	28	125	87	79	20	198	171	74	12	231	176	116
1994	60	25	44	97	80	44	28	153	124	63	13	213	177	92
1995	54	30	47	138	119	58	32	262	247	77	20	342	304	109
1996	135	33	123	134	94	80	85	238	181	127	58	311	172	237
1997	56	29	42	119	87	49	29	201	168	92	17	228	195	110
1998	80	20	55	106	84	51	34	198	135	106	17	262	188	144
1999	49	8	41	79	59	38	22	184	130	116	10	374	309	177
2000	31	15	24	61	47	26	16	85	69	37	1	401	399	38
(1985-2000)														
Avg	65	29	50	114	87	58	31	195	142	106	18	306*	232*	147*

\*15 year average (1985 not available)

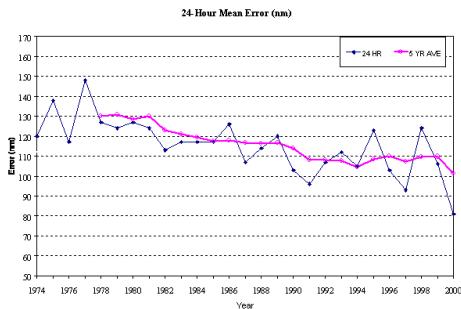


Figure 4-2a. Mean track forecast error (nm) and 5-year running mean for 24 hours for western North Pacific Ocean tropical cyclones from 1974-2000.

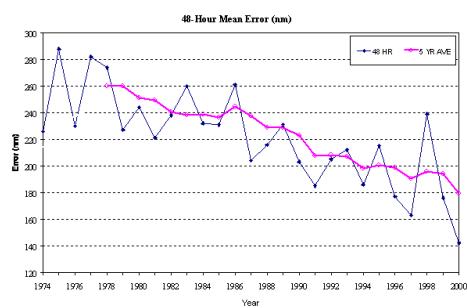


Figure 4-2b. Mean track forecast error (nm) and 5-year running mean for 48 hours for western North Pacific Ocean tropical cyclones from 1974-2000.

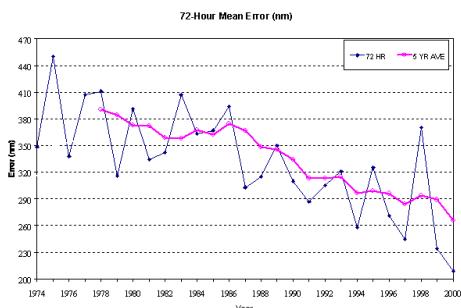


Figure 4-2c. Mean track forecast error (nm) and 5-year running mean for 72 hours for western North Pacific Ocean tropical cyclones from 1974-2000.

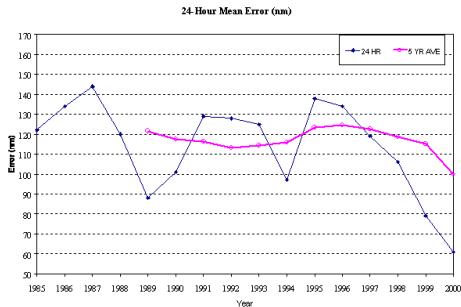


Figure 4-3a. Mean track forecast error (nm) and 5-year running mean for 24 hours for North Indian Ocean tropical cyclones from 1985-2000.

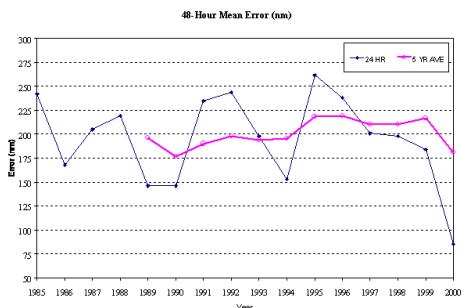


Figure 4-3b. Mean track forecast error (nm) and 5-year running mean for 48 hours, for North Indian Ocean tropical cyclones from 1985-2000.

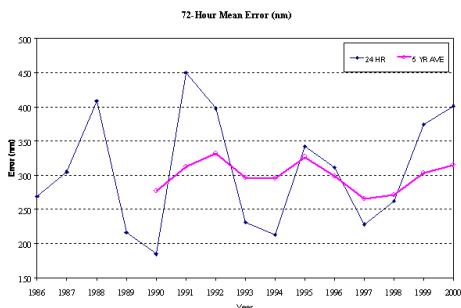


Figure 4-3c. Mean track forecast error (nm) and 5-year running mean for 72 hours for North Indian Ocean tropical cyclones from 1986-2000.

### 4.1.3 SOUTH PACIFIC AND SOUTH INDIAN OCEANS (SOUTHERN HEMISPHERE)

Table 4-3 includes mean track, along-track and cross-track errors for a 16-year period. Figure 4-4 shows mean track errors and a 5-year running mean of track errors at 24- and 48-hours since 1981, and at 72-hours since 1995.

Table 4-3 JTWC INITIAL POSITION AND FORECAST ERRORS (NM) FOR THE SOUTHERN HEMISPHERE 1985-2000															
	Initial Position		24-Hour				48-Hour				72-Hour				
	Number	Error	Number	Track	Along	Cross	Number	Track	Along	Cross	Number	Track	Along	Cross	
1985	306	36	257	134	92	79	193	236	169	132					
1986	279	40	227	129	86	77	171	262	169	164					
1987	189	46	138	145	94	90	101	280	153	138					
1988	204	34	99	146	98	83	48	290	246	144					
1989	287	31	242	124	84	73	186	240	166	136					
1990	272	27	228	143	105	74	177	263	178	152					
1991	264	24	231	115	75	69	185	220	152	129					
1992	267	28	230	124	91	64	208	240	177	129					
1993	257	21	225	102	74	57	176	199	142	114					
1994	386	28	345	115	77	68	282	224	147	134					
1995	245	24	222	108	82	55	175	198	144	108	53	291	169	190	
1996	343	24	298	125	90	67	237	240	174	129	46	277	221	133	
1997	561	24	499	109	82	72	442	210	163	135	150	288	248	175	
1998	329	26	305	111	85	52	245	219	169	108	81	349	261	171	
1999	348	17	322	113	80	64	245	226	159	132	59	286	198	164	
2000	384	12	313	72	47	45	245	135	84	86	58	180	94	139	
(1985-2000)															
Avg	308	28	261	120	84	68	207	230	162	129	75*	279*	199*	162*	

\*6-year average

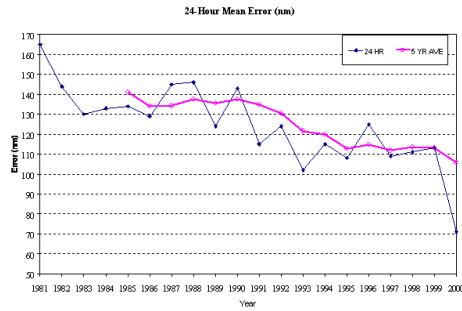


Figure 4-4a. Mean track forecast error (nm) and 5-year running mean for 24 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1981-2000.

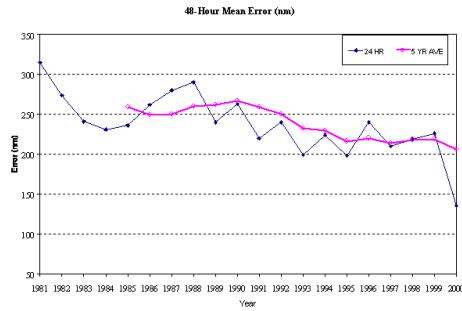


Figure 4-4b. Mean track forecast error (nm) and 5-year running mean for 48 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1981-2000.

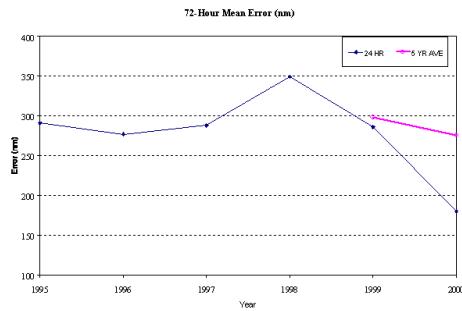


Figure 4-4c. Mean track forecast error (nm) at 72 hours for Southern Hemisphere (Africa to 180 degrees) tropical cyclones from 1995-2000.

## 4.2 TESTING AND RESULTS

A comparison of selected techniques is included in Table 4-4 for all western North Pacific tropical cyclones, Table 4-5 for North Indian Ocean tropical cyclones, and Table 4-6 for Southern Hemisphere tropical cyclones. For example, in Table 4-4 for the homogeneous comparison of the 12-hour mean forecast error between JTWC and NGPS, 324 cases were available. The average forecast error at 12 hours was 62 nm for NGPS and 48 nm for JTWC. The difference of 14 nm is shown in the lower right. Due to computational round-off, differences are not always exact.

Table 4-4 Error Statistics for Selected Objective Techniques

12-HOUR MEAN FORECAST ERROR (NM)

	JTWC	NGPS	CSUM	EGRR	GFDN	JGSM	JTYM	CLIP
JTWC	670	47						
	47	0						
NGPS	324	48	345	64				
	62	14	64	0				
CSUM	595	47	295	62	638	59		
	57	10	57	-5	59	0		
EGRR	2	13	2	62	1	36	2	77
	77	64	77	15	105	69	77	0
GFDN	248	47	0	0	228	59	0	248
	56	9	0	0	55	-4	0	56
JGSM	249	44	243	57	224	53	2	77
	47	3	48	-9	46	-7	33	-44
JTYM	230	43	2	74	211	55	0	0
	47	4	102	28	46	-9	0	46
CLIP	668	47	343	64	638	59	2	77
	57	10	58	-6	58	-1	43	-34

24-HOUR MEAN FORECAST ERROR (NM)

	JTWC	NGPS	CSUM	EGRR	GFDN	JGSM	JTYM	CLIP	NCON
JTWC	609	81							
	81	0							
NGPS	293	84	313	90					
	88	4	90	0					
CSUM	540	80	268	89	583	114			
	113	33	113	24	114	0			
EGRR	289	82	290	88	267	112	315	89	
	85	3	88	0	87	-25	89	0	
GFDN	222	76	0	0	204	115	0	0	222
	85	9	0	0	86	-29	0	0	85
JGSM	237	79	232	85	216	108	231	82	2
	74	-5	75	-10	72	-36	72	-10	183
JTYM	216	76	2	61	199	112	3	70	167
	79	3	125	64	78	-34	125	55	77
CLIP	607	81	311	90	583	114	310	89	221

Table 4-4 Error Statistics for Selected Objective Techniques

	110	29	111	21	111	-3	112	23	106	21	108	33	110	31	113	0
NCON	570	79	284	87	530	113	281	86	214	80	233	74	212	78	593	110
	78	-1	78	-9	78	-35	76	-10	75	-5	71	-3	71	-7	78	-32

## 36-HOUR MEAN FORECAST ERROR (NM)

	JTWC	NGPS	CSUM	EGRR	GFDN	JGSM	JTYM	CLIP
JTWC	544	114						
	114	0						
NGPS	261	116	280	120				
	119	3	120	0				
CSUM	479	112	239	121	524	165		
	164	52	163	42	165	0		
EGRR	2	101	2	132	1	302	2	254
	254	153	254	122	349	47	254	0
GFDN	201	102	0	0	184	167	0	0
	113	11	0	0	115	-52	0	0
JGSM	214	110	210	114	195	157	2	254
	103	-7	101	-13	100	-57	126	-128
JTYM	196	107	2	82	180	167	0	0
	117	10	145	63	116	-51	0	0
CLIP	542	114	279	120	524	165	2	254
	170	56	169	49	170	5	240	-14

## 48-HOUR MEAN FORECAST ERROR (NM)

	JTWC	NGPS	CSUM	EGRR	GFDN	JGSM	JTYM	CLIP	NCON
JTWC	470	142							
	142	0							
NGPS	218	141	242	151					
	149	8	151	0					
CSUM	417	142	206	154	469	216			
	214	72	207	53	216	0			
EGRR	221	142	223	146	209	211	251	146	
	146	4	143	-3	149	-62	146	0	
GFDN	172	133	0	0	159	224	0	0	173
	145	12	0	0	147	-77	0	0	145
JGSM	189	138	183	147	175	204	184	143	2
	135	-3	132	-15	133	-71	128	-15	508
JTYM	173	135	2	133	162	219	2	126	134
	149	14	200	67	149	-70	200	74	144
CLIP	470	142	242	151	469	216	247	148	173
	229	87	229	78	230	14	232	84	229
NCON	442	139	222	149	423	213	221	148	168
	130	-9	133	-16	135	-78	134	-14	126

## 72-HOUR MEAN FORECAST ERROR (NM)

Table 4-4 Error Statistics for Selected Objective Techniques

	JTWC	NGPS	CSUM	EGRR	GFDN	JGSM	JTYM	CLIP	NCON
JTWC	366	209							
	209	0							
NGPS	162	199	184	219					
	217	18	219	0					
CSUM	323	210	156	224	367	303			
	305	95	285	61	303	0			
EGRR	156	194	161	216	152	301	184	203	
	206	12	202	-14	209	-92	203	0	
GFDN	138	195	0	0	131	318	0	0	141 218
	212	17	0	0	217	-101	0	0	218 0
JGSM	145	202	135	213	135	303	136	198	1 550 155 197
	196	-6	193	-20	199	-104	188	-10	168 -382 197 0
JTYM	134	204	0	0	125	319	0	0	107 211 0 0 134 231
	231	27	0	0	231	-88	0	0	234 23 0 0 231 0
CLIP	366	209	184	219	367	303	182	205	141 218 154 194 134 231 448 344
	350	141	333	114	340	37	322	117	337 119 341 147 369 138 344 0
NCON	347	205	168	216	340	305	162	203	137 215 148 196 132 226 381 347 381 206
	200	-5	196	-20	207	-98	192	-11	188 -27 193 -3 195 -31 206 -141 206 0

Table 4-5 Error Statistics for Selected Objective Techniques

## 12-HOUR MEAN FORECAST ERROR (NM)

	JTWC	NGPS	EGRR	GFDN	CLIP
JTWC	28	42			
	42	0			
NGPS	15	39	29	74	
	53	14	74	0	
EGRR	1	21	1	6	42
	42	21	42	36	42 0
GFDN	9	37	0	0	0 19 46
	46	9	0	0	0 46 0
CLIP	27	43	25	70	1 42 17 49 65 52
	47	4	53	-17	21 -21 42 -7 52 0

## 24-HOUR MEAN FORECAST ERROR (NM)

	JTWC	NGPS	EGRR	GFDN	CLIP
JTWC	24	61			
	61	0			
NGPS	14	58	27	86	
	53	-5	86	0	
EGRR	9	55	15	55	21 72
	68	13	58	3	72 0
GFDN	6	77	0	0	1 54 15 91

Table 4-5 Error Statistics for Selected Objective Techniques

	98	21	0	0	202	148	91	0		
CLIP	23	62	23	77	17	75	14	91	59	91
	82	20	91	14	67	-8	83	-8	91	0

## 36-HOUR MEAN FORECAST ERROR (NM)

	JTWC	NGPS	GFDN	CLIP	
JTWC	18	85			
	85	0			
NGPS	11	74	24	93	
	70	-4	93	0	
GFDN	4	119	0	0	12
	158	39	0	0	145
CLIP	17	87	20	77	11
	133	46	132	55	147
				124	-23
				138	0

## 48-HOUR MEAN FORECAST ERROR (NM)

	JTWC	NGPS	EGRR	GFDN	CLIP	
JTWC	16	85				
	85	0				
NGPS	10	70	21	105		
	85	15	105	0		
EGRR	5	38	11	69	16	113
	109	71	88	19	113	0
GFDN	3	116	0	0	0	10
	185	69	0	0	0	185
CLIP	16	85	18	81	13	115
	177	92	183	102	144	29
					172	-13
					182	182
					0	0

## 72-HOUR MEAN FORECAST ERROR (NM)

	JTWC	NGPS	EGRR	GFDN	CLIP	
JTWC	1	401				
	401	0				
NGPS	0	0	14	94		
	0	0	94	0		
EGRR	0	0	5	100	9	186
	0	0	149	49	186	0
GFDN	0	0	0	0	0	4
	0	0	0	0	0	199
CLIP	1	401	12	95	8	182
	341	-60	338	243	281	99
					350	350
					164	164
					314	314
					0	0

Table 4-6 Error Statistics for Selected Objective Techniques

## 12-HOUR MEAN FORECAST ERROR (NM)

Table 4-6 Error Statistics for Selected Objective Techniques

	JTWC	NGPS	EGRR	GFDN	CLIP	HPAC
JTWC	346	41				
	41	0				
NGPS	165	39	278	71		
	69	30	71	0		
EGRR	0	0	0	0	2	74
	0	0	0	0	74	0
GFDN	119	41	0	0	0	229
	50	9	0	0	0	49
CLIP	340	41	259	70	0	229
	64	23	104	34	0	49
HPAC	341	41	260	70	0	642
	57	16	60	-10	0	116
					55	670
					6	61
					-56	0
					60	
					124	
					124	
					0	
24-HOUR MEAN FORECAST ERROR (NM)						
	JTWC	NGPS	EGRR	GFDN	CLIP	HPAC
JTWC	313	72				
	72	0				
NGPS	148	69	255	110		
	104	35	110	0		
EGRR	171	69	230	111	299	83
	72	3	79	-32	83	0
GFDN	109	74	0	0	0	215
	79	5	0	0	0	76
CLIP	308	72	238	109	261	81
	113	41	154	45	148	67
HPAC	308	72	239	109	267	83
	106	34	111	2	110	27
					105	29
					112	-57
					114	0
36-HOUR MEAN FORECAST ERROR (NM)						
	JTWC	NGPS	EGRR	GFDN	CLIP	HPAC
JTWC	282	104				
	104	0				
NGPS	133	99	229	157		
	151	52	157	0		
EGRR	0	0	0	0	1	85
	0	0	0	0	85	0
GFDN	96	103	0	0	0	197
	105	2	0	0	0	104
CLIP	277	103	214	158	0	0
	173	70	218	60	0	197
HPAC	277	104	215	158	0	104
	155	51	159	1	0	557
					154	229
					50	584
					162	165
					-67	0

Table 4-6 Error Statistics for Selected Objective Techniques

## 48-HOUR MEAN FORECAST ERROR (NM)

	JTWC	NGPS	EGRR	GFDN	CLIP	HPAC
JTWC	245	135				
	135	0				
NGPS	115	128	203	197		
	192	64	197	0		
EGRR	134	131	182	200	255	144
	132	1	137	-63	144	0
GFDN	87	136	0	0	0	178
	137	1	0	0	0	133
CLIP	240	134	188	199	218	140
	224	90	270	71	259	119
HPAC	240	134	190	198	225	145
	200	66	208	10	210	65
					204	71
					215	-72
					218	0

## 72-HOUR MEAN FORECAST ERROR (NM)

	JTWC	NGPS	EGRR	GFDN	CLIP	HPAC
JTWC	58	180				
	180	0				
NGPS	25	165	139	273		
	246	81	273	0		
EGRR	28	172	122	272	202	194
	159	-13	184	-88	194	0
GFDN	25	182	0	0	0	139
	194	12	0	0	0	199
CLIP	58	180	131	277	173	191
	327	147	375	98	364	173
HPAC	58	180	133	275	180	194
	257	77	318	43	319	125
					311	112
					332	-57
					335	0

## 5. TROPICAL CYCLONE WARNING VERIFICATION STATISTICS

### 5.1 WARNING VERIFICATION STATISTICS

The verification data in this chapter includes best tracks (6-hourly positions and intensities), and JTWC forecasts (12-, 24-, 36-, 48- and 72-hour position, and intensity). These data are archived and available for download from the JTWC web page.

### 5.2 VERIFICATION TABLES

This section includes this year's verification statistics for each western North Pacific and North Indian Ocean tropical cyclone warned on by JTWC.

Statistics for JTWC on STY 01W Damrey																			
DTG	NO.	WRN BEST TRACK		POSITION ERRORS						WIND ERRORS									
		LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96
00050318		6.2N	135.7E	25															
00050400		7.3N	135.4E	25															
00050406		8.1N	135.3E	25															
00050412		8.6N	135.4E	25															
00050418		9.1N	135.5E	25															
00050500		9.5N	135.2E	25															
00050506		9.8N	134.7E	25															
00050512		10.2N	134.2E	25															
00050518	1	10.8N	133.5E	30	42	48	72	92	131	219			0	0	-15	-20	-20	-40	
00050600	2	11.3N	132.9E	30	50	48	66	98	134	216			0	-5	-20	-25	-20	-50	
00050606	3	11.9N	132.4E	35	5	13	37	72	118	243			-5	-20	-25	-30	-20	-65	
00050612	4	12.4N	132.2E	40	0	38	72	127	168	211			0	-15	-15	-15	-20	-85	
00050618	5	12.8N	131.8E	55	26	78	120	147	176	221	282	318	0	-5	-10	0	-15	-55	10
00050700	6	13.1N	131.6E	60	13	54	108	144	166	230			0	-5	-5	-5	-20	-35	
00050706	7	13.4N	131.5E	65	17	38	74	101	130	194			0	0	15	0	-25	-5	
00050712	8	13.6N	131.5E	70	5	45	80	115	190	277			0	5	10	-5	-45	10	
00050718	9	13.7N	131.5E	75	0	35	89	132	183	204	233		0	15	-5	-15	-55	25	
00050800	10	13.9N	131.6E	75	5	48	92	124	125	118			0	0	-20	-40	-45	30	
00050806	11	14.3N	132.0E	75	0	45	67	87	94	73			0	-20	-35	-45	-10	40	
00050812	12	14.6N	132.4E	85	12	19	88	122	103	97			-5	-25	-45	-35	0	40	
00050818	13	15.1N	133.0E	105	0	53	83	95	115	122			0	-20	-40	10	40	65	
00050900	14	15.7N	133.5E	115	8	58	76	57	47	105			0	-30	-20	25	50	70	
00050906	15	16.4N	134.4E	130	0	36	69	62	74	178			0	-20	25	55	65	75	

Statistics for JTWC on STY 01W Damrey																		
00050912	16	17.3N	135.2E	150	0	29	48	60	68	231		0	0	35	65	70	75	
00050918	17	18.6N	136.1E	155	0	31	55	82	110			0	35	60	70	75		
00051000	18	19.5N	136.8E	140	0	21	12	6	56			0	35	60	60	60		
00051006	19	20.8N	137.6E	105	8	17	17	38	76			0	25	35	35	35		
00051012	20	21.9N	138.3E	90	0	30	12	54	75			0	30	40	40	35		
00051018	21	22.9N	139.1E	65	11	29	48	103				0	10	10	10			
00051100	22	23.8N	139.8E	55	0	31	88	164				5	10	10	5			
00051106	23	25.0N	140.9E	45	0	89	233					0	5	10				
00051112	24	26.1N	142.1E	40	10	100	143					0	5	5				
00051118	25	27.1N	143.6E	35	5	95						0	5					
00051200	26	27.7N	145.8E	30	0	48						5	5					
00051206	27	28.2N	147.8E	25	7							0						
00051212		28.3N	148.9E	25														
		AVERAGE			9	45	77	95	117	184	258	318	1	13	24	28	36	48
		BIAS											0	1	3	6	7	6
		# CASES			27	26	24	22	20	16	2	1	27	26	24	22	20	16
														2	1			

Statistics for JTWC on TS 02W Longwang																			
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS								
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96
00051800		18.2N	122.2E	20															
00051806		18.7N	122.6E	20															
00051812		19.3N	123.3E	20															
00051818	1	20.1N	124.3E	30	39	84	110	160					0	0	0	0	5		
00051900	2	20.9N	125.5E	35	11	45	150						0	0	0	5			
00051906	3	22.1N	127.1E	40	38	51	50						0	10	10				
00051912	4	23.2N	128.6E	45	17	35							-5	5					
00051918	5	24.6N	130.9E	35	82	88							0	5					
00052000	6	26.0N	133.3E	30	1	03							0						
00052006	7	27.3N	135.9E	25	1	80							0						
		AVERAGE			68	60	103	160					1	4	5	5			
		BIAS											-1	4	5	5			
		# CASES			7	5	3	1					7	5	3	1			

Statistics for JTWC on TD 03W																			
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS								
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96
00052100	1	18.3N	118.3E	30	8	104	135						0	0	0	10			
00052106	2	19.5N	119.7E	30	0	54							0	10					
00052112	3	20.4N	121.6E	30	39	205							0	0					
00052118	4	20.8N	123.2E	25	21								0						
00052200	5	21.0N	125.1E	25	32								0						
		AVERAGE			20	121	135						0	3	10				
		BIAS											0	3	10				
		# CASES			5	3	1						5	3	1				

Statistics for JTWC on TD 04W																			
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS								
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96

Statistics for JTWC on TD 04W																				
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00052900		10.5N	116.6E	20																
00052906		10.7N	115.4E	20																
00052912		10.9N	114.2E	20																
00052918		11.1N	113.0E	20																
00053000		11.4N	112.4E	20																
00053006		11.7N	111.8E	20																
00053012		12.0N	111.3E	25																
00053018	1	12.6N	111.2E	25	44	88	89	120					0	5	-5	0				
00053100	2	13.4N	111.1E	25	38	66	104	160					0	0	10	5				
00053106	3	14.2N	110.7E	25	5	30	8						0	0	10					
00053112	4	14.8N	110.0E	30	11	29	42						0	5	10					
00053118	5	15.4N	109.4E	30	60	45							0	0						
00060100	6	16.1N	108.8E	25	0	17							0	0						
00060106	7	16.9N	108.1E	25	13								0							
00060112	8	17.5N	107.5E	25	16								0							
		AVERAGE			24	46	61	140					0	2	9	3				
		BIAS											0	2	6	3				
		# CASES			8	6	4	2					8	6	4	2				

Statistics for JTWC on TY 05W Kirogi																					
	WRN	BEST TRACK			POSITION ERRORS								WIND ERRORS								
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120	
00070200		13.1N	133.4E	25																	
00070206	1	13.6N	133.0E	25	26	42	53	73	95	233			0	-10	-15	-30	-55	-50			
00070212	2	14.2N	132.6E	30	29	46	54	85	95	198			0	-5	-15	-30	-60	-35			
00070218	3	14.7N	132.3E	35	18	12	25	58	86	225	349	489	0	0	-10	-35	-40	-10	30	45	
00070300	4	15.2N	132.1E	40	5	25	69	91	135	280			0	-5	-15	-45	-35	10			
00070306	5	15.9N	131.9E	45	24	42	42	66	107	224	318	570	0	-10	-35	-40	-25	15	15	35	
00070312	6	16.5N	131.8E	55	18	62	90	97	134	202	338	593	0	-10	-40	-25	-10	35	25	55	
00070318	7	17.0N	131.7E	65	12	47	85	123	155	231	417	650	0	-25	-25	-15	5	35	20	30	
00070400	8	17.5N	131.7E	75	16	62	94	139	170	166			0	-30	-20	-5	25	25			
00070406	9	18.4N	131.7E	100	5	13	30	25	17	25			0	0	10	25	30	25			
00070412	10	19.2N	131.7E	115	5	29	60	65	82	43			0	5	15	40	40	25			
00070418	11	20.0N	131.8E	115	16	33	71	75	90	36	166		0	5	25	40	40	30	30		
00070500	12	20.7N	132.0E	115	0	30	62	67	87	31			0	10	40	45	35	35			
00070506	13	21.7N	132.6E	115	0	34	29	89	81	132			0	20	40	45	35	35			
00070512	14	22.4N	133.1E	110	0	29	71	103	36	146			0	20	25	20	15	30			
00070518	15	23.1N	133.6E	100	0	13	13	18	82	199			0	10	15	10	10	30			
00070600	16	24.2N	134.3E	85	0	60	90	25	82	185			0	5	0	-5	0	20			
00070606	17	25.0N	134.8E	85	16	19	5	59	148				0	5	0	0	0	0			
00070612	18	25.8N	135.3E	75	12	22	24	106	189				0	-5	-10	-5	0				
00070618	19	26.9N	136.0E	75	0	16	55	149	138				0	-5	-5	-5	10				
00070700	20	28.0N	136.7E	75	0	32	75	115	61				0	-5	0	5	15				
00070706	21	29.8N	137.6E	75	0	28	94	60					0	0	0	0	15				
00070712	22	31.8N	138.7E	75	0	39	108	148					0	5	10	20					
00070718	23	34.2N	139.9E	70	0	63	104						0	0	0	10					
00070800	24	36.3N	141.2E	65	0	29	104						0	0	0	5					
00070806	25	39.0N	142.8E	65	12	27							0	10							
00070812	26	40.7N	143.6E	55	27	27							0	10							
00070818	27	42.1N	144.6E	45	8								0								
00070900		42.3N	147.1E	40																	

Statistics for JTWC on TY 05W Kirogi																			
AVERAGE				10	34	63	83	104	160	318	575	0	8	16	23	24	28	24	41
BIAS												0	0	0	1	2	16	24	41
# CASES				27	26	24	22	20	16	5	4	27	26	24	22	20	16	5	4

Statistics for JTWC on TC 06W Kai-Tak																				
WRN BEST TRACK				POSITION ERRORS								WIND ERRORS								
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00070306		15.7N	118.1E	15																
00070312		15.9N	119.0E	15																
00070318		16.1N	119.3E	20																
00070400		16.4N	119.6E	20																
00070406	1	17.2N	120.2E	30	8	31	92	244	407	657			0	0	5	0	-15	-30		
00070412	2	18.2N	120.4E	25	20	40	154	284	429	560			0	0	0	-10	-20	-30		
00070418	3	18.5N	120.6E	25	13	64	168	318	471	726			0	0	-5	-20	-25	-30		
00070500	4	18.8N	120.9E	25	0	77	184	340	487	669			0	-5	-15	-25	-25	-30		
00070506	5	19.0N	120.7E	25	5	47	108	175	203	201			0	-10	-30	-35	-40	-25		
00070512	6	19.0N	120.4E	30	6	57	130	194	197	172			0	-15	-25	-25	-30	-15		
00070518	7	19.1N	120.2E	35	0	59	109	126	139	80			0	-15	-20	-25	-20	-5		
00070600	8	19.4N	119.9E	45	0	51	99	96	108	145			0	-5	0	5	15	50		
00070606	9	19.7N	119.4E	55	0	29	53	60	90	268			5	5	5	20	45	65		
00070612	10	20.0N	119.0E	60	8	62	89	122	188	325			0	0	0	15	35	55		
00070618	11	19.9N	118.7E	65	8	59	95	146	201	414			0	-5	0	25	35	55		
00070700	12	19.6N	118.4E	65	17	74	124	206	305	556			0	-5	0	25	35	65		
00070706	13	19.6N	118.8E	75	6	25	64	120	210	532			0	5	25	35	55	70		
00070712	14	19.7N	119.0E	75	0	11	57	148	280	639			0	0	10	25	45	80		
00070718	15	19.8N	119.1E	75	8	31	74	207	345	718			0	10	10	35	45	80		
00070800	16	20.0N	119.4E	75	0	38	114	249	423	773			0	10	10	35	55	85		
00070806	17	20.2N	119.8E	65	6	28	153	290	481				0	-10	10	5	-15			
00070812	18	20.4N	120.3E	65	0	55	234	396	540				0	0	5	15	30			
00070818	19	21.2N	120.7E	65	5	133	276	450	584				0	10	5	15	40			
00070900	20	22.6N	121.5E	65	0	84	190	306	429				0	15	30	55	70			
00070906	21	24.5N	121.6E	55	17	37	16	50					0	5	10	20				
00070912	22	26.4N	121.3E	55	17	24	35	86					0	10	20	20				
00070918	23	28.1N	121.3E	55	18	52	43						0	10	20					
00071000	24	30.3N	121.7E	45	0	13	51						0	15	15					
00071006	25	32.4N	122.3E	45	0	34							0	10						
00071012	26	34.2N	122.6E	30	0	13							0	0						
00071018	27	36.1N	123.1E	30	0								0							
00071100	28	38.0N	123.9E	25	0								0							
		AVERAGE		6	47	113	210	326	465				0	7	11	22	35	48		
		BIAS											0	1	4	10	16	28		
		# CASES		28	26	24	22	20	16				28	26	24	22	20	16		

Statistics for JTWC on TD 07W																				
WRN BEST TRACK				POSITION ERRORS								WIND ERRORS								
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00071100		10.0N	130.6E	20																
00071106		11.0N	129.8E	20																
00071112		12.1N	128.6E	25																
00071118		12.7N	128.2E	25																

Statistics for JTWC on TD 07W																	
00071200		13.2N	127.9E	25													
00071206		13.8N	127.7E	25													
00071212		14.4N	126.9E	25													
00071218		14.9N	125.7E	25													
00071300	1	15.2N	124.6E	25	45	71	76	55	186			0	0	0	-5	0	
00071306	2	15.4N	123.7E	25	71	115	122	53				0	0	0	0		
00071312	3	15.5N	123.0E	25	8	24	101	298				0	0	-5	0		
00071318	4	15.7N	122.2E	25	8	44	188					0	0	-5			
00071400	5	15.9N	121.3E	25	34	130	360					0	-5	-5			
00071406	6	16.1N	120.3E	25	78	250						0	-5				
00071412	7	16.8N	118.9E	30	92	282						-5	-5				
00071418	8	17.2N	116.7E	30	1	28						-5					
00071500	9	17.2N	113.9E	30	2	13						-10					
		AVERAGE			76	131	169	136	186			2	2	3	2	0	
		BIAS										-2	-2	-3	-2	0	
		# CASES			9	7	5	3	1			9	7	5	3	1	

Statistics for JTWC on TD 08W																				
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS									
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00071412		16.1N	115.9E	20																
00071418		16.2N	115.3E	25																
00071500		16.4N	114.7E	25																
00071506		16.7N	114.2E	25																
00071512		17.1N	114.0E	25																
00071518		17.7N	113.7E	25																
00071600	1	18.5N	113.3E	25	8	45	103	174				0	0	0	-5					
00071606	2	19.2N	113.0E	25	24	24	30					0	5	0						
00071612	3	19.9N	112.6E	25	28	23	34					0	5	0						
00071618	4	20.6N	112.2E	25	11	8						0	-5							
00071700	5	21.3N	111.9E	25	16	43						0	-5							
00071706	6	22.0N	111.8E	25	0							0								
00071712	7	22.7N	111.8E	25	22							0								
		AVERAGE			16	29	56	174				0	4	0	5					
		BIAS										0	0	0	-5					
		# CASES			7	5	3	1				7	5	3	1					

Statistics for JTWC on TS 09W Tembin																				
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS									
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00071700		20.5N	144.8E	20																
00071706		20.7N	144.0E	20																
00071712		21.4N	143.6E	20																
00071718	1	22.1N	143.2E	25	8	38	66	98	90	102		0	0	0	-5	0	15			
00071800	2	22.9N	143.0E	30	17	45	66	87	99	119		0	5	0	10	20	35			
00071806	3	23.8N	142.8E	30	5	22	40	60	69	160		0	0	0	10	20	40			
00071812	4	24.8N	142.7E	30	8	18	54	60	91	162		0	-10	0	10	20	40			
00071818	5	25.7N	142.5E	35	0	30	54	80	111	209		0	-5	10	20	20	20			
00071900	6	26.5N	142.4E	45	16	18	32	62	93	101		0	10	20	20	20	25			
00071906	7	27.3N	142.3E	45	8	6	37	50	36	117		0	5	10	20	30	35			

Statistics for JTWC on TS 09W Tembin																		
00071912	8	28.0N	142.1E	45	7	42	55	60	84	226		0	5	10	20	30	35	
00071918	9	28.9N	141.9E	45	8	24	28	41	50	212		0	0	10	20	20	25	
00072000	10	29.8N	141.7E	45	12	26	21	23	43	174		0	5	15	20	20	20	
00072006	11	30.6N	141.6E	45	0	21	8	23	56			0	5	5	0	0		
00072012	12	31.4N	141.8E	45	7	6	28	54	178			0	5	5	5	0		
00072018	13	32.2N	142.0E	40	0	27	30	30	109			0	0	-5	-5	-5		
00072100	14	32.7N	142.1E	40	5	8	24	104				0	0	0	-10			
00072106	15	33.3N	142.1E	35	4	24	102	259				0	-5	-5	-5			
00072112	16	34.2N	142.3E	35	11	16	109	250				0	0	-5	-5			
00072118	17	34.9N	142.5E	35	20	39	11					0	0	0				
00072200	18	35.9N	143.1E	30	7	53	18					0	-5	-5				
00072206	19	37.1N	144.2E	30	12	81						0	0					
00072212	20	38.7N	145.9E	30	9	76						0	0					
00072218	21	40.2N	147.6E	25	0							0						
00072300	22	41.8N	149.5E	25	7							0						
		AVERAGE			8	31	44	84	85	158		0	3	6	12	16	29	
		BIAS										0	1	4	8	15	29	
		# CASES			22	20	18	16	13	10		22	20	18	16	13	10	

Statistics for JTWC on TD 10W																		
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS							WIND ERRORS						
		LAT	LONG		00	12	24	36	48	72	96	00	12	24	36	48	72	96
00072000	1	12.3N	130.8E	25	11	35	71	142	213	320		0	0	0	5	10	25	
00072006	2	13.1N	130.8E	25	34	52	86	181	253			0	0	0	5	10		
00072012	3	13.8N	130.4E	25	30	25	71	160	214			0	5	10	10	15		
00072018	4	14.4N	130.0E	25	42	26	46	119	202			0	5	5	10	15		
00072100	5	15.1N	129.5E	25	16	71	133	178	239			0	5	5	10	20		
00072106	6	15.8N	129.0E	25	18	91	143	196				0	0	5	10			
00072112	7	16.7N	127.9E	25	8	69	170	279				0	0	5	15			
00072118	8	17.2N	126.8E	25	12	43	94					0	0	0	5			
00072200	9	17.5N	125.6E	25	6	44	110					0	0	0	5			
00072206	10	17.5N	124.7E	25	34	61						0	0	0				
00072212	11	17.5N	123.9E	25	68	70						0	0	5				
00072218	12	17.5N	123.0E	25	12							0						
00072300	13	17.5N	122.1E	20	23							5						
		AVERAGE			25	53	103	179	224	320		0	2	4	9	14	25	
		BIAS										0	2	4	9	14	25	
		# CASES			13	11	9	7	5	1		13	11	9	7	5	1	

Statistics for JTWC on TS 11W Bolaven																				
WRN BEST TRACK		POSITION ERRORS												WIND ERRORS						
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00072406		19.0N	123.1E	20																
00072412		20.1N	123.8E	20																
00072418	1	21.4N	124.6E	25	42	20	61	143	144	169		0	0	5	0	0	0			
00072500	2	23.0N	125.2E	30	0	0	77	109	114	206		0	5	5	5	-10	-15			
00072506	3	23.9N	125.4E	30	6	45	80	66	71	269		0	0	-5	-5	-10	-15	-15		
00072512	4	24.5N	125.9E	30	10	81	95	64	129	311		0	-5	-5	-10	-15	-20			
00072518	5	25.0N	126.7E	30	27	95	84	27	60	151		0	-5	-10	-10	-15	-20			
00072600	6	25.4N	128.0E	35	5	16	37	66	94	84		0	-5	-10	-5	-10	-15			

Statistics for JTWC on TS 11W Bolaven																	
00072606	7	26.1N	129.0E	40	13	21	32	77	95	112		0	0	0	-5	-10	-15
00072612	8	26.6N	129.6E	40	16	32	84	130	146	181		0	-5	0	-5	-15	-25
00072618	9	27.0N	130.0E	45	17	40	86	105	94	80		0	0	0	-5	-10	-20
00072700	10	27.2N	130.0E	50	8	42	66	76	107	134		0	5	5	0	-5	-5
00072706	11	27.3N	129.9E	50	12	29	58	98	120	161		0	0	0	-5	-10	0
00072712	12	27.3N	129.7E	50	12	27	64	94	108	167		0	0	0	-5	-10	0
00072718	13	27.3N	129.5E	50	16	46	90	104	114	177		0	5	5	0	-10	0
00072800	14	27.5N	129.3E	50	0	12	21	17	24	123		0	5	5	0	0	0
00072806	15	27.8N	129.1E	50	13	55	88	97	108	134		0	5	5	0	5	0
00072812	16	28.1N	129.0E	50	24	65	75	91	108	22		0	0	-5	0	0	5
00072818	17	28.4N	128.9E	50	18	19	17	21	23			-5	-5	-5	5	0	
00072900	18	28.8N	128.8E	50	23	42	61	65	69			0	0	5	5	5	
00072906	19	29.2N	128.6E	50	5	32	41	42	24			0	-5	10	5	5	
00072912	20	29.9N	128.5E	50	5	36	60	110	55			0	10	10	10	10	
00072918	21	30.7N	128.5E	50	11	13	36	94				0	15	10	10		
00073000	22	31.5N	128.5E	40	7	19	79	13				0	5	5	5		
00073006	23	32.7N	128.7E	35	5	56	78					0	0	0			
00073012	24	33.7N	128.9E	35	5	24	103					0	5	5			
00073018	25	34.8N	129.3E	35	25	63						0	0				
00073100	26	36.1N	129.8E	30	7	129						0	0				
00073106	27	38.2N	131.1E	30	0							0					
00073112		41.1N	133.1E	25													
		AVERAGE			13	41	66	78	90	155		0	3	5	5	8	10
		BIAS										0	1	1	0	-5	-9
		# CASES			27	26	24	22	20	16		27	26	24	22	20	16

Statistics for JTWC on TS 12W Chanchu																				
WRN BEST TRACK				POSITION ERRORS						WIND ERRORS										
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00072612		6.4N	178.0W	20																
00072618		6.9N	178.2W	25																
00072700		7.5N	178.6W	25																
00072706		8.0N	179.8W	20																
00072712		8.4N	179.0E	20																
00072718		8.7N	178.0E	20																
00072800	1	9.2N	177.1E	25	37	91	174	240					0	-10	-10	5				
00072806	2	9.8N	176.4E	30	36	138	251	339					-5	-10	-10	10				
00072812	3	10.6N	176.1E	35	86	212	311						-5	-5	10					
00072818	4	11.4N	176.1E	35	50	90	146						0	5	25					
00072900	5	12.2N	176.0E	35	16	84							5	20						
00072906	6	13.0N	175.8E	35	8	47							5	20						
00072912	7	13.7N	175.7E	25	8								10							
00072918	8	14.3N	175.6E	20	11								5							
		AVERAGE			32	110	221	289					4	12	14	8				
		BIAS											2	3	4	8				
		# CASES			8	6	4	2					8	6	4	2				

Statistics for JTWC on TY 13W Jelewat																				
WRN BEST TRACK				POSITION ERRORS						WIND ERRORS										
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120

Statistics for JTWC on TY 13W Jelewat																		
00073112	21.7N	155.2E	15															
00073118	22.0N	154.3E	20															
00080100 1	21.9N	153.2E	30	8	24	42	32	0	92		-5	-20	-45	-65	-70	-55		
00080106 2	22.0N	152.1E	45	8	19	23	30	45	32		0	-10	-50	-45	-50	-20		
00080112 3	22.0N	151.2E	55	12	23	23	45	42	44		-10	-35	-50	-50	-40	-20		
00080118 4	22.0N	150.2E	65	5	16	26	55	55	71	155	281	5	-35	-30	-55	-40	-35	-55
00080200 5	22.1N	149.4E	90	8	18	43	76	89	92		10	-10	-5	-10	-15	-25		
00080206 6	22.4N	148.4E	115	16	21	64	89	94	89		0	10	-10	0	-10	-20		
00080212 7	22.7N	147.5E	115	16	37	41	35	36	114		0	5	0	5	-10	-20		
00080218 8	23.2N	146.5E	115	8	16	16	16	36	122	176	217	0	0	10	10	-10	-15	-30
00080300 9	23.8N	145.5E	120	11	16	33	45	53	120		0	10	15	10	-10	-15		
00080306 10	24.4N	144.2E	125	8	18	34	74	113	234		0	15	20	10	5	-15		
00080312 11	24.9N	143.0E	115	0	20	55	81	108	201		0	10	10	5	5	-20		
00080318 12	25.3N	141.7E	105	11	12	34	54	84	164	194	221	-5	0	-5	-5	-10	-30	-25
00080400 13	25.7N	140.3E	100	5	19	48	64	93	184		0	0	-5	-5	-10	-30		
00080406 14	26.0N	139.0E	95	6	25	45	77	116	213		0	-5	-5	-10	-20	-30		
00080412 15	26.0N	137.7E	95	6	6	29	40	62	130		0	-5	-5	-10	-25	-20		
00080418 16	26.1N	136.4E	95	5	17	37	50	78	156	240	192	0	5	0	-10	-20	-10	-20
00080500 17	26.1N	135.4E	95	5	8	24	48	91	168		0	5	0	-10	-15	-5		
00080506 18	26.1N	134.4E	90	0	24	52	80	118	171		0	0	-5	-10	-15	5		
00080512 19	26.1N	133.5E	90	12	40	50	72	86	112		0	0	-10	-10	-5	5		
00080518 20	26.0N	132.7E	90	17	40	77	105	124	185	121	79	0	-5	-10	-10	0	0	10
00080600 21	26.0N	131.9E	90	0	24	60	86	117	159		0	-10	-10	-5	0	0		
00080606 22	26.0N	131.2E	95	5	24	49	54	87	94		0	-5	-5	5	5	-5		
00080612 23	25.9N	130.5E	100	6	25	45	72	95	80		0	0	10	5	5	-5		
00080618 24	25.9N	130.0E	100	8	29	49	81	93	79	133		0	0	15	10	0	5	35
00080700 25	26.0N	129.6E	100	10	20	60	84	102	109		0	10	15	10	0	10		
00080706 26	26.2N	129.2E	100	8	19	48	56	65	45		0	15	20	5	-5	15		
00080712 27	26.5N	128.7E	90	0	16	20	16	24	63		0	5	10	0	-10	20		
00080718 28	26.9N	128.3E	85	5	19	16	29	58	126		-5	0	-10	-20	-15	20		
00080800 29	27.4N	128.1E	85	5	34	51	74	106	140		-5	0	-10	-20	-10	25		
00080806 30	27.8N	127.8E	80	8	25	47	83	114	119		0	-5	-15	-10	-5	35		
00080812 31	28.0N	127.4E	80	15	13	29	51	72	10		0	-5	-15	-5	10	25		
00080818 32	28.2N	127.0E	85	0	12	34	70	90		-5	-15	-10	-5	30				
00080900 33	28.5N	126.5E	85	5	16	43	71	59		-5	-10	0	10	25				
00080906 34	28.8N	125.8E	90	0	42	83	95	80		0	5	5	25	35				
00080912 35	28.9N	125.0E	90	6	32	75	71	67		0	5	15	25	25				
00080918 36	29.0N	124.2E	80	6	32	36	8			10	10	30	30					
00081000 37	29.1N	123.4E	75	10	47	36	19			5	25	30	25					
00081006 38	29.1N	122.6E	70	5	32	43				0	25	30						
00081012 39	29.4N	121.6E	55	23	36	78				10	10	10						
00081018 40	30.0N	120.7E	40	48	73					5	5							
00081100 41	30.4N	120.2E	35	27	97					0	10							
00081106 42	30.8N	120.0E	25	36						0								
00081112 31.2N	119.8E	20																
	AVERAGE	10	27	44	59	79	120	170	198	2	9	14	15	16	18	25	32	
	BIAS									0	0	-2	-5	-8	-7	-13	-28	
	# CASES	42	41	39	37	35	31	6	5	42	41	39	37	35	31	6	5	

Statistics for JTWC on TD 14W																			
WRN BEST TRACK				POSITION ERRORS								WIND ERRORS							
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	00	12	24	36	48	72	96	120

Statistics for JTWC on TD 14W															
00080706		24.5N	147.0E	20											
00080712		25.2N	145.7E	20											
00080718		26.2N	144.6E	25											
00080800		28.1N	144.0E	25											
00080806	1	29.3N	143.6E	25	0	27	31	84	147		0	0	0	-5	0
00080812	2	30.5N	143.3E	30	15	68	107	210	287		-5	0	0	-5	5
00080818	3	31.5N	143.4E	30	0	48	61	121			0	0	-5	0	
00080900	4	32.4N	144.0E	30	5	10	56	102			0	0	-5	5	
00080906	5	33.4N	144.7E	30	7	23	84				0	0	0		
00080912	6	34.4N	145.6E	30	5	60	115				0	0	5		
00080918	7	35.2N	147.0E	30	19	92					0	5			
00081000	8	35.7N	149.2E	30	7	34					0	10			
00081006		36.2N	151.3E	25											
00081012		36.7N	153.9E	20											
		AVERAGE			8	45	76	129	217		1	2	3	4	3
		BIAS									-1	2	-1	-1	3
		# CASES			8	8	6	4	2		8	8	6	4	2

Statistics for JTWC on TY 15W Ewiniar																			
DTG	NO.	WRN BEST TRACK		POSITION ERRORS							WIND ERRORS								
		LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96
00080818		14.2N	142.7E	20															
00080900		14.1N	142.0E	20															
00080906	1	14.1N	141.3E	25	18	66	75	147	294	264		0	0	0	0	-10	25		
00080912	2	14.4N	140.4E	30	50	77	12	159	324	358		0	5	10	5	0	30		
00080918	3	15.0N	139.8E	30	25	21	121	294	373	336		0	0	0	-10	0	30		
00081000	4	15.9N	139.3E	30	8	54	188	312	265	267		5	10	5	0	20	30		
00081006	5	17.0N	139.1E	35	0	88	222	267	149	300		0	0	-10	0	30	35		
00081012	6	18.7N	139.0E	35	6	138	246	204	142	289		0	-5	-10	10	30	35		
00081018	7	20.5N	138.8E	45	17	156	193	104	75	182	302	284	-5	-15	-5	25	35	40	0
00081100	8	23.1N	138.8E	50	18	127	73	43	104	285		0	-5	15	35	40	45		
00081106	9	25.6N	138.0E	65	0	36	110	108	168	250		0	10	45	50	50	45		
00081112	10	27.7N	137.2E	65	16	98	97	157	198	192		0	15	35	30	25	20		
00081118	11	29.0N	136.4E	65	23	124	99	117	125	33		0	20	15	25	25	-5		
00081200	12	29.3N	135.4E	55	13	48	63	71	58	41		0	5	-5	10	15	-25		
00081206	13	29.5N	136.0E	45	18	39	67	103	153	149		0	5	5	10	10	-25		
00081212	14	30.5N	136.5E	45	15	79	84	79	95	47		0	0	10	5	-5	-35		
00081218	15	30.9N	137.2E	45	19	74	93	110	96	95		0	5	10	0	-30	-40		
00081300	16	31.1N	138.0E	50	11	24	60	101	84	60		0	10	15	5	-40	-40		
00081306	17	31.5N	139.3E	45	5	21	63	95	113	72		0	5	10	-20	-40	-35		
00081312	18	31.9N	140.9E	45	6	27	85	85	103	35		0	0	0	-35	-40	-25		
00081318	19	32.4N	142.3E	45	0	54	61	78	91	39		0	0	-20	-35	-40	-10		
00081400	20	33.1N	144.0E	45	0	42	23	20	13	129		0	0	-35	-40	-40	-15		
00081406	21	33.7N	145.4E	45	5	12	23	39	36	111		0	-20	-35	-40	-35	-15		
00081412	22	34.2N	146.8E	45	7	32	13	19	34	99		0	-30	-35	-35	-25	-10		
00081418	23	34.5N	147.7E	65	17	38	43	31	68	201		0	-20	-30	-30	-10	-10		
00081500	24	34.8N	148.4E	75	0	23	56	118	168	242		0	-5	-5	5	15	10		
00081506	25	35.2N	149.4E	75	4	28	74	130	180	273		0	-5	0	20	15	10		
00081512	26	35.5N	150.2E	75	0	34	90	144	186	261		0	0	10	20	20	25		
00081518	27	36.1N	150.7E	75	7	34	78	125	173	298		0	5	25	20	20	25		
00081600	28	36.8N	150.7E	70	6	20	52	84	112	257		0	10	15	15	10	10		
00081606	29	37.4N	150.7E	65	6	26	52	94	128	243		5	25	15	15	10	10		

Statistics for JTWC on TY 15W Ewiniar																		
00081612	30	38.1N	150.7E	55	19	61	79	96	149	275		0	10	10	0	0	0	0
00081618	31	38.3N	150.4E	40	24	18	13	23	48	49		0	-5	0	-5	-5	-5	-5
00081700	32	38.4N	150.0E	40	5	19	47	61	31	117		0	0	0	0	-5	-5	-5
00081706	33	38.5N	149.9E	40	5	8	41	62	41			0	0	0	0	0	-5	-5
00081712	34	38.7N	149.7E	35	6	28	50	37	5			0	0	5	0	0	-5	-5
00081718	35	38.8N	149.6E	35	22	33	67	89	44			0	-5	0	-5	-5	-5	-5
00081800	36	39.0N	149.6E	35	0	18	63	53	33			0	0	0	-5	-5	-5	-5
00081806	37	39.3N	149.6E	35	5	33	64	28				0	0	0	0	0	0	0
00081812	38	39.5N	149.3E	30	12	37	50	40				0	0	-5	0	0	0	0
00081818	39	39.7N	149.0E	30	0	66	77					0	0	0	0	0	0	0
00081900	40	39.3N	148.6E	30	7	61	110					0	0	0	0	0	0	0
00081906	41	39.0N	149.1E	30	0	63						0	5					
00081912		39.1N	150.1E	30														
00081918		39.5N	150.9E	25														
00082000		40.1N	151.3E	25														
		AVERAGE			11	51	79	103	124	183	302	284	0	6	11	15	20	23
		BIAS											0	1	2	1	1	4
		# CASES			41	41	40	38	36	32	1	1	41	41	40	38	36	32
															1	1		

Statistics for JTWC on TS 16W Wene																				
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS									
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00081418		32.3N	178.6E	20																
00081500		32.7N	179.2E	20																
00081506	1	33.1N	179.7E	25	0	50	93	133					0	-25	-20	-15				
00081512	2	33.4N	179.8W	25	0	41	70	147					0	-30	-15	-15				
00081518	3	33.7N	179.2W	55	7	30	44	45					-20	-10	-10	-10				
00081600	4	34.4N	178.5W	55	12								-10							
00081606	5	35.4N	177.8W	45	11								0							
00081612	6	36.4N	177.4W	40	4								0							
00081618	7	37.7N	176.8W	40	7								0							
00081700	8	38.9N	176.3W	40	12								0							
00081706	9	40.2N	175.8W	35	9								0							
		AVERAGE			7	41	69	108					3	22	15	13				
		BIAS											-3	-22	-15	-13				
		# CASES			9	3	3	3					9	3	3	3				

Statistics for JTWC on TD 17W																				
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS									
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00081618		30.8N	169.2E	25																
00081700		31.1N	170.1E	20																
00081706		31.5N	171.0E	25																
00081712		31.8N	171.8E	25																
00081718	1	32.1N	172.5E	25	10	148	278					0	5	10						
00081800	2	32.4N	173.4E	25	6	85	199					0	10	10						
00081806	3	32.7N	174.9E	25	7	38						0	5							
00081812	4	33.2N	176.3E	25	15	77						0	5							
00081818	5	33.7N	177.8E	25	13							0								
00081900	6	35.7N	179.9W	25	29							0								
		AVERAGE			10	100	200	100	100	100	100	0	10	10	10	10	10	10	10	
		BIAS			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		# CASES			6	6	6	6	6	6	6	0	0	0	0	0	0	0	0	

Statistics for JTWC on TD 17W																				
WRN BEST TRACK			POSITION ERRORS						WIND ERRORS											
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00081706		8.3N	139.2E	25																
00081712		8.8N	139.1E	25																
00081718		9.5N	139.1E	20																
00081800		10.2N	138.8E	25																
00081806	1	11.1N	138.3E	25	1	01	129	85	71	138	249			0	-5	-20	-20	-20	-60	
00081812	2	12.2N	137.7E	25	42	24	50	102	130	286			0	-25	-20	-30	-35	-70		
00081818	3	12.9N	137.0E	35	31	76	136	167	181	232			-5	-20	-25	-30	-50	-75		
00081900	4	13.7N	136.2E	55	24	21	64	84	110	136			0	5	-10	-20	-40	-60		
00081906	5	14.4N	135.4E	55	13	33	64	83	106	127			0	-5	-10	-35	-50	-60		
00081912	6	15.1N	134.5E	55	18	42	67	95	115	122			-5	-15	-25	-45	-60	-60		
00081918	7	15.8N	133.5E	65	5	27	36	64	95	143	257			0	-5	-30	-45	-55	-40	20
00082000	8	16.4N	132.5E	75	8	17	13	25	45	77			0	-10	-30	-45	-45	-25		
00082006	9	17.0N	131.6E	75	13	18	35	47	52	77			0	-25	-40	-50	-45	-5		
00082012	10	17.5N	130.7E	90	8	29	40	42	66	61			0	-15	-20	-20	-10	20		
00082018	11	18.1N	129.5E	105	6	29	40	48	37	142			0	-15	-25	-20	-25	20		
00082100	12	18.7N	128.3E	115	0	25	25	29	5	118			0	-15	-15	-10	-15	30		
00082106	13	19.2N	127.2E	125	5	34	57	56	60	124			0	-10	-5	-15	5	25		
00082112	14	19.7N	126.1E	135	11	38	49	16	48				0	0	5	-5	20			
00082118	15	20.3N	125.0E	140	0	11	53	25	42				0	10	-20	30	30			
00082200	16	20.9N	123.9E	140	8	25	25	33	49				0	5	0	10	25			
00082206	17	21.6N	122.9E	140	6	66	65	38	50				0	-5	10	20	15			
00082212	18	22.5N	121.9E	140	0	55	38	35					0	0	35	15				
00082218	19	23.8N	120.7E	130	0	37	73	53					0	30	30	15				
00082300	20	24.3N	118.9E	120	5	45	75						0	5	15					
00082306	21	25.0N	117.9E	90	12	68	68						0	5	5					
00082312	22	25.2N	116.9E	65	24	50							0	0						
00082318	23	25.4N	116.3E	45	5	40							0	5						
00082400	24	25.7N	116.0E	35	0								0							
00082406		26.5N	116.0E	30																
		AVERAGE		15	41	55	58	78	146	257			0	10	19	25	32	42	20	
		BIAS											0	-5	-9	-16	-21	-28	20	
		# CASES		24	23	21	19	17	13	1			24	23	21	19	17	13	1	

Statistics for JTWC on TS 19W Kaemi																				
WRN BEST TRACK			POSITION ERRORS						WIND ERRORS											
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00081818		11.0N	114.7E	20																
00081900		11.2N	114.5E	20																
00081906		11.4N	114.3E	20																
00081912		11.6N	114.1E	20																
00081918		12.0N	113.8E	20																
00082000		12.5N	113.6E	20																
00082006	1	12.9N	113.3E	25	18	13	25	48	87				0	5	5	0	0			

Statistics for JTWC on TS 19W Kaemi																											
00082012	2	13.4N	112.9E	25	8	12	50	76	121																		
00082018	3	13.8N	112.5E	25	31	73	142	174	196																		
00082100	4	14.3N	112.1E	25	37	94	166	227	236																		
00082106	5	14.8N	111.7E	30	0	64	121	156									-5										
00082112	6	15.3N	110.9E	35	13	70	121	150									0										
00082118	7	15.6N	110.0E	40	11	40	70									0											
00082200	8	15.8N	109.2E	45	11	59	87									0											
00082206	9	16.1N	108.3E	45	0	52											0										
00082212	10	16.3N	107.4E	35	18	60											0										
00082218	11	16.4N	106.8E	30	0											0											
00082300	12	16.5N	106.2E	25	0											0											
AVERAGE																	0										
BIAS																	0										
# CASES																	12										
																	10										
																	8										
																	6										
																	4										

Statistics for JTWC on TY 20W Prapiroon																			
DTG	NO.	WRN BEST TRACK		POSITION ERRORS								WIND ERRORS							
		LAT	LONG	wind	00	12	24	36	48	72	96	00	12	24	36	48	72	96	120
00082400		7.8N	137.9E	25															
00082406		8.9N	137.8E	20															
00082412		9.6N	136.7E	20															
00082418		10.6N	135.1E	25															
00082500		11.6N	133.1E	25															
00082506		12.4N	131.5E	25															
00082512		13.1N	131.0E	25															
00082518		14.0N	131.2E	25															
00082600	1	14.8N	131.4E	25	13	99	126	110	74	39		0	0	0	10	20	20		
00082606	2	16.3N	131.7E	30	17	112	127	78	50	37		0	0	5	15	25	25		
00082612	3	18.1N	131.7E	30	56	89	120	143	180	192		0	0	5	15	25	25		
00082618	4	19.8N	131.3E	35	62	85	140	178	238	275		0	10	20	30	30	-10		
00082700	5	21.1N	130.7E	35	50	113	156	207	257	281		0	10	20	30	20	-20		
00082706	6	21.9N	129.9E	35	61	92	137	195	222	204		0	10	20	20	20	-40		
00082712	7	22.3N	129.2E	35	61	111	179	250	304	276		0	10	20	10	10	-50		
00082718	8	22.6N	128.4E	35	24	38	107	173	218	313		0	5	5	5	0	-45		
00082800	9	22.9N	127.6E	35	18	53	97	121	163	354		0	5	-5	5	-5	-40		
00082806	10	23.2N	126.9E	35	52	85	109	157	236	436		0	-5	-5	-5	-10	-45		
00082812	11	23.3N	126.4E	35	48	66	71	146	198	399		0	-15	-5	-10	-20	-40		
00082818	12	23.6N	125.9E	45	25	49	71	82	156	425		0	0	0	0	-20	-5		
00082900	13	24.0N	125.5E	55	36	50	65	83	171	367		0	0	-5	0	-15	-5		
00082906	14	24.5N	125.1E	55	5	8	26	47	58	225		0	0	0	0	-15	0		
00082912	15	25.2N	124.5E	55	16	6	49	80	105	308		0	-5	0	5	-20	-5		
00082918	16	26.0N	124.1E	65	13	21	36	36	108			0	0	10	10	10			
00083000	17	26.9N	123.7E	70	8	39	101	122	206			0	10	25	10	10			
00083006	18	28.6N	123.3E	75	0	19	36	156	223			0	5	5	10	15			
00083012	19	29.9N	123.3E	75	0	56	91	161	199			0	5	0	10	5			
00083018	20	31.7N	123.4E	75	24	62	151	186				0	5	20	15				
00083100	21	33.6N	123.8E	70	23	43	121	213				0	0	20	20				
00083106	22	35.2N	124.0E	70	0	58	147					0	20	15					
00083112	23	37.2N	125.1E	65	0	90	157					0	10	5					
00083118	24	39.6N	127.1E	45	12	37						0	5						
00090100	25	41.4N	129.0E	40	18	138						-5	5						
00090106	26	42.6N	131.7E	35	23							0							

Statistics for JTWC on TY 20W Prapiroon																	
00090112		43.7N	134.9E	30	AVERAGE	26	65	105	139	177	275	0	6	9	11	16	25
		BIAS										0	4	8	10	4	-16
		# CASES				26	25	23	21	19	15	26	25	23	21	19	15

Statistics for JTWC on TS 21W Maria																			
DTG	NO.	WRN BEST TRACK		POSITION ERRORS						WIND ERRORS									
		LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96
00082712		21.4N	115.2E	20															
00082718		21.3N	115.3E	20															
00082800	1	21.1N	115.4E	25	24	49	94	153	182	173			0	0	0	0	-5	-10	
00082806	2	20.8N	115.6E	25	16	48	68	119	162	149			0	0	0	-5	-5	-15	
00082812	3	20.3N	115.7E	30	17	6	66	111	130	169			-5	-5	-5	-5	10	-5	
00082818	4	19.8N	115.7E	30	20	25	83	128	140	233			5	0	0	0	5	-5	
00082900	5	19.3N	115.6E	35	13	51	83	157	204	389			0	0	0	5	0	10	
00082906	6	18.8N	115.7E	35	18	17	69	116	153	185			0	0	5	5	0	-10	
00082912	7	18.5N	115.9E	35	25	46	112	196	288	400			0	0	10	0	-10	0	
00082918	8	18.5N	116.0E	40	29	81	148	238	337	484			0	5	5	-5	-10	5	
00083000	9	18.6N	116.1E	40	42	54	97	152	257				5	10	0	-10	5		
00083006	10	18.8N	116.1E	40	70	61	13	34	88				-5	-5	-5	-10	-10	-10	
00083012	11	19.2N	116.1E	35	21	24	25	62	75				0	-10	-10	0	-5		
00083018	12	19.7N	116.1E	40	8	23	46	94	100				-5	-15	-15	0	0		
00083100	13	20.4N	116.0E	45	16	17	48	74					-10	-15	-5	0			
00083106	14	21.0N	115.8E	50	8	11	39	13					0	5	0	0			
00083112	15	21.6N	115.6E	55	0	28	55						0	20	5				
00083118	16	22.4N	115.1E	55	0	28	68						0	-5	0				
00090100	17	23.3N	114.4E	40	0	28							5	0					
		AVERAGE			20	35	70	118	176	273			2	6	4	3	5	8	
		BIAS											-1	-1	-1	-2	-2	-4	
		# CASES			17	17	16	14	12	8			17	17	16	14	12	8	

Statistics for JTWC on STY 22W Saomai																			
DTG	NO.	WRN BEST TRACK		POSITION ERRORS						WIND ERRORS									
		LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96
00090118		15.9N	158.5E	20															
00090200		16.0N	158.0E	20															
00090206		16.2N	157.3E	20															
00090212	1	16.1N	156.4E	25	13	36	74	96	152	350			0	-5	-10	-15	-15	15	
00090218	2	16.0N	155.6E	35	24	67	100	157	241	547			0	0	0	-10	-20	20	
00090300	3	15.9N	154.9E	35	24	82	127	203	299	666			0	-5	-10	-20	-20	25	
00090306	4	15.9N	154.2E	45	5	13	48	91	170	479			0	10	15	5	35	60	
00090312	5	15.9N	153.5E	50	0	24	54	109	216	438			0	0	5	5	45	55	
00090318	6	16.0N	152.6E	55	11	37	80	180	375	568	576	676	0	-5	-5	25	45	60	45
00090400	7	16.1N	151.6E	65	6	38	86	221	418	542			0	-5	0	40	55	65	
00090406	8	16.1N	150.7E	70	5	27	93	274	413	444			0	-15	20	40	55	65	
00090412	9	16.1N	149.8E	80	6	35	164	356	435	439			0	0	45	55	55	65	
00090418	10	16.1N	149.0E	90	8	31	176	280	307	237	171	155	0	30	50	60	55	35	5
00090500	11	16.0N	148.2E	90	11	117	283	337	323	250	161	84	0	30	25	15	30	30	-20
00090506	12	15.7N	147.7E	70	52	178	268	303	237	173			0	15	25	30	35	20	
00090512	13	15.0N	147.6E	60	18	55	81	93	72	138			0	10	10	20	25	10	

Statistics for JTWC on STY 22W Saomai																			
00090518	14	14.2N	147.5E	60	8	21	6	79	107	119		0	5	10	15	20	-5		
00090600	15	13.7N	147.7E	55	21	126	121	126	145	94		0	-10	-10	-10	-15	-30		
00090606	16	14.0N	147.6E	55	6	13	112	154	181	164		0	0	0	5	-10	-20		
00090612	17	14.5N	147.3E	60	5	35	115	165	190	183		-5	0	0	-5	-10	-25		
00090618	18	15.0N	146.9E	55	8	52	98	115	111	91	129	82	0	5	5	-10	-10	-35	-65 -25
00090700	19	16.0N	146.0E	55	13	25	83	80	75	66		0	5	-5	-10	-15	-35		
00090706	20	17.0N	144.9E	55	8	35	53	48	42	58		0	5	-10	-15	-15	-35		
00090712	21	17.5N	143.8E	55	13	45	49	24	28	43		0	-10	-15	-25	-35	-65		
00090718	22	17.9N	142.6E	55	30	48	42	56	77	109		0	-20	-25	-15	-35	-45		
00090800	23	18.3N	141.3E	65	12	34	52	99	122	150		0	0	-5	0	-10	-5		
00090806	24	18.9N	140.4E	75	13	38	60	109	124	79		0	-5	-5	-20	-10	0		
00090812	25	19.5N	139.5E	75	11	37	54	100	85	56		0	-10	-15	-20	-30	10		
00090818	26	20.3N	138.4E	85	11	17	28	24	50	73		0	5	-15	-10	-25	10		
00090900	27	20.9N	137.5E	90	5	16	25	18	66	79		0	0	-10	-25	-10	0		
00090906	28	21.6N	136.8E	90	8	25	49	13	29	37	51	174	0	-20	-10	-25	-5	10 15 10	
00090912	29	22.4N	136.1E	100	8	44	37	47	40	27		0	-15	-30	-15	5	15		
00090918	30	23.2N	135.2E	120	8	41	86	81	88	126		0	5	-10	10	30	30		
00091000	31	23.8N	134.1E	120	8	62	103	114	138	230		0	-20	-5	15	15	25		
00091006	32	24.1N	133.0E	120	0	40	60	58	73	90		0	-15	0	20	25	25		
00091012	33	24.2N	132.5E	140	8	35	27	36	32	28		0	10	25	25	35	40		
00091018	34	24.4N	132.0E	140	8	11	16	21	27	76	143	240	0	15	30	35	40	40 45 60	
00091100	35	24.7N	131.5E	130	5	16	24	16	44	85		0	15	20	30	25	10		
00091106	36	25.2N	130.8E	125	0	21	42	34	11	48		0	15	25	30	20	5		
00091112	37	25.5N	130.2E	115	6	30	36	24	41	177	151		5	10	20	15	10	0 10	
00091118	38	25.8N	129.5E	110	0	13	16	56	110	259		0	10	10	10	10	5		
00091200	39	26.0N	128.9E	110	0	8	21	72	131	271		0	10	10	10	0	10		
00091206	40	26.3N	128.3E	100	0	16	34	53	135	240		0	5	0	0	-15	0		
00091212	41	26.6N	127.8E	95	6	21	43	107	185	239		0	5	5	-5	-15	5		
00091218	42	27.0N	127.1E	90	12	24	30	67	174	206		0	-5	-5	-15	-15	-5		
00091300	43	27.4N	126.5E	90	8	0	48	138	234	323		0	0	-10	-15	-5	5		
00091306	44	27.8N	125.8E	90	6	48	90	186	309	294		0	0	-10	-10	0	15		
00091312	45	27.9N	125.3E	85	7	66	109	211	308			0	-5	-10	-5	-5			
00091318	46	27.9N	124.9E	85	7	53	104	203	196			0	-5	-5	0	-5			
00091400	47	28.0N	124.5E	90	12	18	131	219	172			-10	-5	5	5	5	5		
00091406	48	28.1N	124.3E	90	8	34	145	156	112			0	0	10	5	15			
00091412	49	28.4N	124.3E	90	5	55	113	148				0	10	15	15				
00091418	50	28.6N	124.5E	85	10	79	106	188				0	5	0	10				
00091500	51	29.1N	125.3E	75	6	59	156					0	5	10					
00091506	52	30.1N	126.3E	70	0	90	156					0	0	15					
00091512	53	31.8N	127.4E	65	5	65						0	5						
00091518	54	34.0N	128.1E	65	5	42						0	15						
00091600	55	36.7N	128.9E	55	0							0							
00091606	56	39.5N	129.5E	45	0							0							
		AVERAGE		9	43	83	123	159	213	197	235	0	8	12	17	22	25	28	27
		BIAS										0	1	3	5	7	11	9	-2
		# CASES		56	54	52	50	48	44	7	6	56	54	52	50	48	44	7	6

Statistics for JTWC on TY 23W Wukong																				
WRN	BEST	POSITION ERRORS								WIND ERRORS										
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00090418		16.9N	116.9E	20																
00090500		16.8N	116.9E	25																

Statistics for JTWC on TY 23W Wukong																	
00090506	1	16.8N	117.0E	25	17	6	92	178	276	576		0	5	0	0	-20	-55
00090512	2	16.8N	117.1E	25	18	77	118	186	315	645		0	0	0	-25	-20	-55
00090518	3	17.1N	117.6E	25	13	66	111	139	160	246		0	-5	-10	-30	-20	-35
00090600	4	17.8N	117.8E	30	6	40	64	62	69	128		0	-5	-35	-30	-30	-40
00090606	5	18.3N	117.5E	35	8	29	29	40	63	160		0	-5	-30	-25	-45	-30
00090612	6	18.6N	117.0E	35	17	34	34	51	85	199		0	-30	-30	-35	-45	-20
00090618	7	18.7N	116.6E	40	21	18	33	38	56	98		0	-20	-15	-35	-30	-30
00090700	8	18.9N	116.1E	65	12	29	29	40	39	57		0	15	15	0	-15	0
00090706	9	19.0N	115.6E	65	13	0	8	17	29	13		0	5	-15	-15	-10	15
00090712	10	19.0N	115.2E	65	6	25	32	53	43	36		0	-5	-15	-20	0	35
00090718	11	18.9N	114.7E	65	13	35	48	55	32			0	-20	-20	-10	-5	
00090800	12	18.8N	114.0E	75	18	13	29	51	47			0	-15	-15	10	10	
00090806	13	18.7N	113.4E	90	5	13	21	29	44			0	5	15	10	35	
00090812	14	18.7N	112.5E	90	0	21	52	71	131			0	0	25	15	55	
00090818	15	18.4N	111.6E	90	0	29	36	83				0	0	-15	0		
00090900	16	18.3N	110.6E	95	0	21	21	67				0	15	10	20		
00090906	17	18.2N	109.6E	75	0	25	54					0	10	40			
00090912	18	18.3N	108.7E	65	5	12	63					0	0	35			
00090918	19	18.4N	107.9E	70	11	46						-5	5				
00091000	20	18.4N	107.0E	65	6	39						-5	10				
00091006	21	18.3N	105.9E	45	0							0					
00091012		18.3N	104.8E	25													
		AVERAGE			9	29	49	73	99	216		0	9	19	18	24	32
		BIAS										0	-2	-3	-11	-10	-22
		# CASES			21	20	18	16	14	10		21	20	18	16	14	10

Statistics for JTWC on TS 24W Bopha																			
DTG	NO.	WRN BEST TRACK		POSITION ERRORS						WIND ERRORS									
		LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96
00090518	1	20.7N	135.8E	25	20	66	101	131	217	401		0	0	0	0	0	0	0	0
00090600	2	21.0N	136.0E	25	36	57	33	86	232	379		0	-5	-5	0	-10	-5		
00090606	3	21.4N	136.1E	25	37	50	34	8	22	60		0	-5	-5	-10	-10	-5		
00090612	4	22.0N	136.1E	30	32	33	30	77	81	101		0	-5	0	-10	-5	0		
00090618	5	22.5N	135.8E	30	50	55	98	130	119	121		0	-5	-10	-15	-5	0		
00090700	6	23.0N	135.2E	35	33	72	165	173	116	182		0	5	-10	-15	0	0		
00090706	7	23.5N	134.3E	35	12	36	68	121	225	610		0	-5	-10	-5	5	-5		
00090712	8	24.1N	132.9E	35	17	88	121	172	280	653		0	-10	-10	0	5	-10		
00090718	9	24.6N	131.3E	45	18	48	56	76	147	309		0	-5	-5	5	0	-5		
00090800	10	25.1N	129.6E	50	18	32	45	56	113	234		0	-5	0	5	0	0		
00090806	11	25.5N	128.3E	55	0	38	24	48	109	223		0	0	5	5	-5	5		
00090812	12	25.8N	127.0E	55	6	21	22	54	50	114		0	5	5	5	-10	15		
00090818	13	25.8N	125.9E	55	31	90	116	147	160	157		0	5	0	-10	-15	-5		
00090900	14	25.5N	125.2E	50	22	23	69	104	128			0	-5	-10	-25	-20			
00090906	15	25.0N	124.7E	45	18	44	93	136	189			0	-5	-15	-20	-15			
00090912	16	24.4N	124.1E	45	8	50	98	140	191			0	-5	-20	-15	-5			
00090918	17	23.5N	123.3E	45	0	34	102	197				0	-10	-20	-20				
00091000	18	22.4N	122.7E	45	5	22	91	230				0	-15	-15	-10				
00091006	19	21.5N	122.3E	50	0	0	80	126				0	-5	0	0				
00091012	20	20.4N	122.0E	55	0	21	126	171				0	0	10	10				
00091018	21	19.4N	121.9E	50	5	32	64					0	-5	0					
00091100	22	18.6N	121.9E	45	5	42	55					0	0	5					
00091106	23	17.9N	122.0E	40	8	65						0	0						

Statistics for JTWC on TS 24W Bopha																	
00091112	24	17.1N	122.3E	30	18	105										0	5
00091118	25	16.4N	123.2E	30	13											0	
00091200	26	15.9N	124.5E	20	43											0	
		AVERAGE		18	47	77	119	149	273							0	5
		BIAS														0	-3
		# CASES		26	24	22	20	16	13							26	24
																22	20
																16	13

Statistics for JTWC on TY 25W Sonami																				
WRN BEST TRACK				POSITION ERRORS								WIND ERRORS								
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00091400		21.7N	138.4E	20																
00091406	1	22.0N	139.2E	25	6	25	50	110	146	62			0	-5	-5	-20	-20	-20		
00091412	2	22.4N	139.8E	30	0	16	61	94	126	39			0	-5	-5	-20	-20	-15		
00091418	3	22.8N	140.4E	35	0	49	111	215	239	124			0	5	-10	-5	0	-40		
00091500	4	23.1N	140.7E	40	5	96	223	250	188	112			0	5	-5	0	5	-40		
00091506	5	23.4N	141.0E	40	6	28	88	94	41	207			0	-15	-10	-10	-15	-25		
00091512	6	23.8N	141.3E	45	10	37	64	72	57				0	-15	-10	-5	-15			
00091518	7	24.3N	141.6E	60	13	36	36	21	55				0	0	5	-10	-15			
00091600	8	25.1N	141.8E	65	12	27	29	67	69				0	0	5	0	-10			
00091606	9	26.1N	141.7E	65	31	30	102	162	228				0	0	0	0	0			
00091612	10	27.4N	141.6E	70	6	61	129	201					0	5	5	0				
00091618	11	29.0N	141.4E	70	5	20	50	108					0	0	-10	-5				
00091700	12	31.0N	141.5E	70	0	23	79						0	-10	-15					
00091706	13	33.2N	142.1E	75	12	112	186						0	-5	-5					
00091712	14	35.9N	143.2E	75	6	80							0	-10						
00091718	15	38.7N	144.4E	75	7	40							0	0						
00091800	16	41.6N	146.2E	75	7								0							
00091806		44.5N	148.7E	65																
		AVERAGE		8	45	93	127	128	109				0	5	7	7	11	28		
		BIAS											0	-3	-5	-7	-10	-28		
		# CASES		16	15	13	11	9	5				16	15	13	11	9	5		

Statistics for JTWC on STY 26W Shanshan																				
WRN BEST TRACK				POSITION ERRORS								WIND ERRORS								
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00091518		15.1N	178.1E	20																
00091600		15.0N	177.1E	20																
00091606		14.7N	176.2E	20																
00091612		14.5N	175.3E	20																
00091618		14.3N	174.6E	25																
00091700		14.3N	174.0E	25																
00091706		14.4N	173.4E	25																
00091712	1	14.5N	173.0E	25	42	67	96	119	192	255			0	-10	-20	-20	-25	-60		
00091718	2	14.8N	172.6E	30	50	67	54	79	124	64			0	-10	-15	-20	-35	-60		
00091800	3	15.2N	172.1E	40	13	0	6	54	62	71			-5	-10	-5	-10	-25	-45		
00091806	4	15.6N	171.5E	45	0	18	18	71	53	54			5	5	0	-15	-20	-40		
00091812	5	16.0N	170.9E	55	18	32	26	6	34	66			0	0	-10	-20	-35	-35		
00091818	6	16.4N	170.3E	55	16	94	186	165	144	129			0	0	-15	-10	-25	-15		
00091900	7	16.9N	170.0E	60	24	92	128	122	95	115			0	-10	-20	-25	-25	-15		
00091906	8	17.5N	169.9E	65	29	69	38	30	23	40			0	-20	-25	-45	-45	-35		

Statistics for JTWC on STY 26W Shanshan																	
00091912	9	18.3N	169.8E	75	29	92	148	140	113	93		0	-15	-30	-35	-25	-10
00091918	10	19.2N	169.5E	90	18	92	109	112	97	61		0	0	-10	-10	0	5
00092000	11	19.8N	168.6E	95	8	37	102	122	150	213		-5	-15	-10	-5	0	15
00092006	12	20.3N	167.9E	100	11	16	50	79	105	189		0	-20	-15	-10	0	20
00092012	13	20.9N	167.2E	115	0	16	24	42	76	221		0	-5	0	-5	5	25
00092018	14	21.3N	166.7E	125	11	34	45	84	125	267		0	0	5	0	5	25
00092100	15	21.7N	166.3E	125	16	29	57	95	161	379		0	5	5	10	15	25
00092106	16	22.3N	165.9E	130	5	8	44	101	173	539		-5	0	10	15	20	25
00092112	17	22.9N	165.6E	125	6	25	77	130	214	732		5	0	15	20	25	25
00092118	18	23.5N	165.3E	130	12	45	79	83	133			5	10	20	25	35	
00092200	19	24.2N	165.3E	130	11	32	84	132	284			5	20	20	10	25	
00092206	20	24.9N	165.4E	125	5	40	107	164	344			10	25	25	25	25	
00092212	21	25.5N	165.6E	115	0	54	135	227	502			0	10	10	20	10	
00092218	22	26.6N	166.1E	110	0	26	68	249				0	20	35	20		
00092300	23	27.6N	166.5E	100	0	35	148	395				0	5	15	10		
00092306	24	28.9N	167.4E	95	8	12	103					0	10	10			
00092312	25	30.0N	168.4E	90	7	35	158					0	10	5			
00092318	26	31.1N	170.0E	75	50	200						0	10				
00092400	27	33.1N	172.3E	65	69	219						0	-5				
00092406	28	35.5N	174.4E	65	30							-5					
00092412		39.3N	176.6E	60													
		AVERAGE			18	55	84	122	153	205		2	9	14	17	20	28
		BIAS										0	0	0	-3	-5	-9
		# CASES			28	27	25	23	21	17		28	27	25	23	21	17

Statistics for JTWC on TD 27W																		
DTG	NO.	WRN BEST TRACK		POSITION ERRORS						WIND ERRORS								
		LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72
00092718		23.9N	165.1E	20														
00092800		24.5N	165.1E	20														
00092806		25.1N	165.1E	20														
00092812		25.8N	165.2E	25														
00092818	1	26.7N	165.4E	25	26	61	103	158	194			0	0	5	10	5		
00092900	2	27.3N	165.7E	30	22	56	103	147				5	5	5	5			
00092906	3	27.9N	166.1E	30	6	32	67	83				5	0	5	0			
00092912	4	28.3N	166.4E	30	12	28	73					0	5	0				
00092918	5	28.7N	166.8E	30	13	50	90					0	0	0				
00093000	6	29.1N	167.3E	25	8	18						0	0	0				
00093006	7	29.4N	167.8E	25	5	25						0	0	0				
00093012		29.8N	168.1E	25														
00093018		30.0N	168.2E	25														
		AVERAGE			13	38	87	129	194			1	1	3	5	5		
		BIAS										1	1	3	5	5		
		# CASES			7	7	5	3	1			7	7	5	3	1		

Statistics for JTWC on TS 28W																		
DTG	NO.	WRN BEST TRACK		POSITION ERRORS						WIND ERRORS								
		LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72
00100618	1	10.8N	110.5E	30	17	85	202	311				0	0	-5	-15			
00100700	2	10.7N	110.7E	30	25	106	203	318				0	-5	-5	-15			

Statistics for JTWC on TS 28W																	
00100706	3	10.7N	110.9E	30	39	45	50	56	80	101		0	0	-5	-5	-5	10
00100712	4	10.7N	111.2E	30	43	48	57	63	78	108		0	0	-5	-5	-5	15
00100718	5	10.8N	111.5E	30	26	38	38	31	60	167		0	-5	-10	-5	-10	-5
00100800	6	10.9N	111.7E	30	8	19	21	51	85	214		0	-5	-5	-5	0	-5
00100806	7	11.0N	112.0E	35	6	26	76	82	88	222		0	-5	-5	-5	5	5
00100812	8	11.2N	112.3E	35	13	59	83	96	96	290		0	-5	-5	5	15	5
00100818	9	11.5N	112.2E	40	30	63	64	79	159	363		0	0	5	15	20	0
00100900	10	11.8N	111.8E	40	42	47	71	66	167	375		0	0	15	25	20	-10
00100906	11	12.2N	111.6E	40	63	89	85	139	251	452		0	0	15	25	15	-10
00100912	12	12.5N	111.3E	40	80	115	136	209	302	466		0	10	20	20	5	-10
00100918	13	12.7N	110.9E	40	75	80	156	290	424			0	10	10	0	-5	
00101000	14	12.8N	110.6E	30	23	82	169	292				0	0	-5	-10		
00101006	15	13.2N	110.5E	30	0	8	78	158	252			0	0	-5	-5	-15	
00101012	16	13.3N	110.6E	25	8	30	94	189	284			0	0	-5	-10	-15	
00101018	17	13.4N	110.7E	25	0	54	103	204	325			0	0	-5	-10	-15	
00101100	18	13.7N	111.0E	25	17	82	163	269	348			0	0	-10	-10	-20	
00101106	19	13.9N	111.5E	25	0	55	155	280	301			0	0	-10	-15	-20	
00101112	20	14.3N	111.8E	25	0	75	198	275				0	-10	-10	-20		
00101118	21	14.5N	112.1E	25	18	72	165	166	172			0	-10	-10	-20	0	
00101200	22	15.1N	112.5E	30	26	66	114	128	146			0	-5	-15	-5	5	
00101206	23	15.7N	112.7E	30	13	84	70	82	120			0	0	-10	5	0	
00101212	24	16.6N	112.9E	30	29	23	6	52	99			0	-5	5	5	0	
00101218	25	17.3N	113.0E	30	16	72	79	92	113			0	0	20	15	0	
00101300	26	17.6N	112.5E	35	17	36	88	150				0	15	5	0		
00101306	27	17.6N	111.7E	35	51	75	121					-10	0	0			
00101312		17.6N	111.1E	25													
00101318		17.5N	110.7E	20													
00101400		17.5N	110.4E	20													
00101406		17.4N	110.0E	20													
00101412		17.4N	109.7E	20													
00101418		17.4N	109.5E	20													
		AVERAGE		26	61	106	159	188	276			0	3	8	11	9	8
		BIAS										0	-1	-1	-2	-1	-1
		# CASES		27	27	27	26	21	10			27	27	27	26	21	10

Statistics for JTWC on TY 29W Yagi																				
WRN BEST TRACK				POSITION ERRORS							WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00102100		19.7N	145.6E	20																
00102106		20.1N	144.0E	20																
00102112		20.7N	141.9E	25																
00102118	1	21.0N	140.1E	30	6	8	16	42	49	144		0	0	0	0	-15	-55			
00102200	2	21.0N	138.6E	35	5	19	34	49	64	188		0	5	0	-5	-15	-50			
00102206	3	21.3N	137.1E	35	8	8	25	53	94	276		0	-5	-5	-15	-25	-40			
00102212	4	21.5N	135.6E	35	8	23	16	31	72	233		0	-10	-15	-20	-45	-25			
00102218	5	21.8N	134.1E	40	6	46	46	53	72	234		-5	-10	-20	-25	-55	-25			
00102300	6	22.1N	132.6E	45	8	23	21	42	95	330		0	-10	-15	-40	-45	-25			
00102306	7	22.4N	131.2E	45	8	37	71	117	195	489		0	-15	-20	-50	-30	-15			
00102312	8	22.6N	130.2E	55	6	21	58	121	212	503		-10	-15	-40	-45	-20	-10			
00102318	9	22.8N	129.2E	60	0	21	64	142	250	518		0	-5	-40	-25	-25	-5			
00102400	10	23.0N	128.2E	65	0	25	73	137	246	474		0	-25	-35	-15	-10	5			
00102406	11	23.4N	127.2E	70	6	18	66	131	256	395		0	-15	-15	-15	-15	5			

Statistics for JTWC on TY 29W Yagi																	
00102412	12	23.7N	126.3E	95	5	25	87	198	333	359		0	0	-10	-10	-15	15
00102418	13	24.1N	125.5E	105	12	40	102	216	326	318		0	20	5	0	-10	20
00102500	14	24.6N	124.9E	105	16	55	163	307	369	287		0	10	10	5	0	10
00102506	15	25.1N	124.6E	90	5	44	145	244	266	228		0	-5	0	0	10	10
00102512	16	25.6N	124.4E	85	5	22	49	82	145			0	0	5	15	15	
00102518	17	26.0N	124.6E	80	12	59	101	165	234			-5	5	10	25	20	
00102600	18	26.2N	125.2E	75	5	52	79	55	19			0	5	10	20	15	
00102606	19	26.4N	126.0E	65	13	36	28	49	65			0	0	5	5	5	
00102612	20	26.5N	126.6E	60	6	81	131	158				0	5	5	0		
00102618	21	26.3N	126.9E	55	0	77	129	157				0	15	15	10		
00102700	22	25.9N	126.8E	45	20	12	40					0	0	0			
00102706	23	25.4N	126.1E	35	28	70	110					0	5	5			
00102712	24	25.1N	125.6E	30	5	56						0	0				
00102718	25	24.9N	124.7E	25	13	33						0	5				
00102800	26	24.9N	123.9E	25	5							0					
00102806	27	25.2N	123.2E	20	12							0					
		AVERAGE			8	36	72	121	177	332		1	8	12	16	21	21
		BIAS										-1	-2	-6	-9	-14	-12
		# CASES			27	25	23	21	19	15		27	25	23	21	19	15

Statistics for JTWC on TY 30W Xangsane																			
DTG	NO.	WRN BEST TRACK		POSITION ERRORS						WIND ERRORS									
		LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96
00102506		8.6N	137.2E	20															
00102512	1	9.0N	136.0E	30	18	79	109	106	147	150		0	5	0	-10	-10	-10		
00102518	2	9.4N	134.6E	30	45	113	95	110	176	248		0	0	-10	-10	-15	0		
00102600	3	9.7N	133.2E	30	30	24	66	116	153	275		0	-10	-20	-15	-10	5		
00102606	4	10.1N	131.5E	35	18	24	35	90	98	139		0	-15	-15	-30	-30	-10		
00102612	5	10.5N	130.1E	45	13	51	68	76	84	121		0	-15	-15	-25	-25	-5		
00102618	6	11.0N	129.0E	55	8	40	101	88	73	192		0	-10	-20	-15	-5	-10		
00102700	7	12.2N	128.1E	65	8	71	82	76	42	237		0	-5	0	-10	0	-25		
00102706	8	12.3N	126.3E	65	6	67	53	78	75	130		0	-20	-20	-15	0	-25		
00102712	9	13.2N	124.9E	70	24	43	34	54	12	195		0	-10	-30	-15	-5	-25		
00102718	10	13.7N	123.6E	75	6	42	32	24	71	258	434	1008	0	-10	-10	-5	-10	-25	5
00102800	11	13.9N	122.5E	65	6	17	50	64	136	268		0	-10	10	20	-5	-5		
00102806	12	14.2N	121.5E	65	5	31	64	98	162	285		0	10	20	20	0	0		
00102812	13	14.6N	120.6E	65	21	51	50	98	166	247		0	10	20	-5	0	0		
00102818	14	15.2N	119.9E	55	8	13	57	135	195	332		0	10	10	-5	-5	-5		
00102900	15	15.8N	119.0E	55	8	31	89	163	197	374		0	10	-15	-5	-10	-10		
00102906	16	15.8N	118.4E	55	18	55	104	129	129	354		0	0	-15	-5	-15	5		
00102912	17	16.0N	118.1E	55	11	42	87	83	90	379		0	-25	-15	-20	-25	5		
00102918	18	16.2N	118.1E	65	16	75	128	126	184	741		0	-25	-15	-20	-20	10		
00103000	19	16.4N	118.3E	90	8	39	40	74	195			0	10	25	15	5			
00103006	20	16.8N	118.7E	90	5	26	54	135	192			0	15	25	20	20			
00103012	21	17.3N	119.2E	90	0	29	86	147	220			0	15	25	25	35			
00103018	22	18.0N	119.5E	90	0	23	77	132	329			0	-10	-15	-5	0			
00103100	23	18.6N	119.7E	90	12	28	88	88				0	0	0	15				
00103106	24	19.6N	120.1E	90	8	21	67	272				0	0	15	20				
00103112	25	20.9N	120.6E	90	0	60	180					0	5	30					
00103118	26	22.6N	121.3E	85	6	37	147					-5	0	0					
00110100	27	24.5N	122.0E	80	13	54						0	10						
00110106	28	26.5N	123.1E	65	18	91						0	10						

Statistics for JTWC on TY 30W Xangsane																						
00110112	29	28.9N	125.6E	50	15											0						
00110118	30	31.9N	129.4E	45	59											0						
				AVERAGE	14	46	79	107	142	274	434	1008	0	10	15	15	11	10	30	5		
				BIAS											0	-2	-1	-3	-6	-7	-30	5
				# CASES	30	28	26	24	22	18	1	1	30	28	26	24	22	18	1	1		

Statistics for JTWC on TY 31W Bebinca																						
WRN BEST TRACK				POSITION ERRORS								WIND ERRORS										
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120		
00103018		6.8N	134.5E	25																		
00103100	1	7.9N	133.4E	25	5	12	53	68	109	75			0	5	0	0	-20	-40				
00103106	2	8.8N	132.2E	25	13	24	13	49	78	46			0	5	0	-10	-30	-30				
00103112	3	9.5N	131.0E	25	23	51	34	29	18	13			0	-5	-10	-20	-40	-20				
00103118	4	10.0N	130.0E	25	23	24	61	91	94	25			0	-5	-20	-30	-30	-15				
00110100	5	10.6N	129.1E	35	13	47	59	93	94	42			0	-5	-15	-25	-5	-15				
00110106	6	11.3N	128.2E	35	13	41	82	87	76	44			0	-15	-25	-25	5	-15				
00110112	7	12.1N	126.9E	45	0	18	31	42	27	128			0	-20	-30	-20	10	15				
00110118	8	12.8N	126.0E	55	0	18	12	13	48	166	254	275	0	-20	-35	-10	15	20	-5	15		
00110200	9	13.5N	124.8E	65	8	6	40	55	87	201			-5	-30	-25	0	10	20				
00110206	10	14.1N	123.5E	75	11	44	76	60	86	142			0	-30	-10	15	20	15				
00110212	11	14.4N	122.4E	85	8	35	32	24	70	131			0	0	20	35	35	10				
00110218	12	14.5N	121.4E	85	8	13	30	60	88	133	107	133	5	10	25	35	35	10	40			
00110300	13	14.7N	120.4E	75	5	27	45	61	79	123			15	20	20	30	35	10				
00110306	14	15.0N	119.6E	65	0	21	50	58	87	124			15	25	35	50	30	10				
00110312	15	15.3N	119.0E	55	11	26	54	73	93	121			0	0	10	35	25	35				
00110318	16	15.8N	118.3E	50	13	31	56	105	150	145			0	0	10	15	25	45				
00110400	17	16.1N	117.8E	55	21	6	36	87	141	112			0	5	10	5	10	30				
00110406	18	16.5N	117.4E	55	11	26	66	121	154	98			0	5	5	5	10	35				
00110412	19	16.8N	117.1E	55	12	17	62	111	132	103			0	10	0	5	30	35				
00110418	20	17.0N	117.0E	55	6	21	54	78	87	103			0	-5	-15	-20	5	10				
00110500	21	17.4N	116.9E	55	23	62	93	97	97	194			0	-15	-20	-5	5	10				
00110506	22	17.9N	116.9E	60	16	51	70	64	91				-5	-10	-20	5	10					
00110512	23	18.5N	116.9E	65	17	45	58	56	86				0	0	10	20	20					
00110518	24	19.0N	116.9E	65	20	34	52	59	117				0	-5	20	20	10					
00110600	25	19.5N	116.9E	65	16	46	81	112	163				0	15	25	20	15					
00110606	26	19.9N	116.8E	65	16	43	102	152					0	25	30	20						
00110612	27	20.1N	116.6E	45	24	66	112	157					0	10	10	5						
00110618	28	20.2N	116.2E	35	25	79	139						0	5	0							
00110700	29	20.4N	115.6E	30	11	51	97						-5	-5	-5							
00110706	30	20.7N	114.9E	25	8	41							0	-5								
00110712	31	21.0N	114.2E	25	33	50							0	0								
00110718	32	21.3N	113.5E	25	24								0									
00110800	33	21.5N	112.9E	20	8								0									
				AVERAGE	14	35	60	76	94	108	180	204	2	10	16	18	19	21	23	28		
				BIAS											1	-1	0	6	9	8	18	28
				# CASES	33	31	29	27	25	21	2	2	33	31	29	27	25	21	2	2		

Statistics for JTWC on TD 32W																				
WRN BEST TRACK				POSITION ERRORS								WIND ERRORS								
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00110112	29	28.9N	125.6E	50	15								0							

Statistics for JTWC on TD 32W																	
00110712		18.0N	125.5E	20													
00110718		18.7N	124.8E	20													
00110800	1	19.6N	124.3E	25	16	70	175	245	323			0	0	5	15	20	
00110806	2	20.7N	124.2E	25	37	96	241	355	393			0	0	5	20	15	
00110812	3	21.7N	124.2E	25	25	89	161	191				0	5	10	15		
00110818	4	22.8N	124.4E	25	0	65	156	154				0	0	5	5		
00110900	5	24.4N	125.2E	30	0	40	110					0	0	5			
00110906	6	25.7N	126.5E	30	12	71	151					0	5	0			
00110912	7	26.7N	128.1E	30	17	91						0	0				
00110918	8	27.2N	130.2E	25	24	135						0	0				
00111000		27.6N	132.2E	25													
00111006		27.9N	133.9E	25													
		AVERAGE			17	82	166	236	358			0	1	5	14	18	
		BIAS										0	1	5	14	18	
		# CASES			8	8	6	4	2			8	8	6	4	2	

Statistics for JTWC on TS 33W Rumbia																					
DTG	NO.	WRN	LAT	LONG	POSITION ERRORS						WIND ERRORS										
					BEST	TRACK	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96
00112718		8.4N	132.4E	25																	
00112800	1	8.5N	131.8E	30	13	63	189	220	211	174		0	0	5	5	-15	-20				
00112806	2	8.5N	131.2E	30	18	65	107	96	103	138		0	-5	0	5	-15	-20				
00112812	3	8.7N	130.7E	35	8	94	115	108	126	148		0	-5	0	0	-15	-20				
00112818	4	8.3N	130.5E	40	0	64	55	81	136	164	146	93	10	15	25	25	0	10	35	50	
00112900	5	8.6N	130.8E	40	6	24	32	78	135	123		10	10	10	-5	-20	-5				
00112906	6	8.7N	130.3E	45	8	19	48	105	127	122		5	10	10	-5	-20	0				
00112912	7	9.0N	129.6E	45	21	66	67	98	114	113		5	5	10	-5	-20	5				
00112918	8	9.3N	128.7E	45	5	13	38	63	87	183		5	0	-5	-10	0	25				
00113000	9	9.7N	127.8E	50	18	49	68	94	153	202		5	10	0	-10	5	25				
00113006	10	10.1N	127.0E	50	18	58	71	116	177	174		5	5	-5	0	10	30				
00113012	11	10.6N	126.2E	50	21	67	119	212	278	227		5	-5	-5	5	20	30				
00113018	12	11.2N	125.3E	50	8	38	91	178	216	214		5	-5	0	10	20	30				
00120100	13	11.7N	124.2E	50	0	41	140	214	227	267		0	-5	5	20	20	30				
00120106	14	12.0N	123.0E	50	8	89	183	207	194	205		0	0	10	20	25	30				
00120112	15	12.2N	122.3E	50	42	138	194	225	194	208		-5	5	20	15	20	10				
00120118	16	12.1N	121.8E	45	35	128	156	136	142	271		-10	0	15	15	10	-10				
00120200	17	11.7N	121.2E	40	11	19	34	73	54	118		-10	0	5	20	15	-10				
00120206	18	11.5N	120.7E	35	13	53	100	106	63	65		-5	0	10	20	15	-10				
00120212	19	11.4N	119.8E	30	8	61	113	84	66	89		-5	-5	5	10	10	-10				
00120218	20	11.4N	118.7E	30	6	34	49	116	140	124		-5	0	5	10	0	-10				
00120300	21	11.4N	117.4E	30	30	77	25	58	72	86		0	5	10	15	0	-15				
00120306	22	11.4N	116.1E	25	13	24	46	85	137			0	0	0	-10	-15					
00120312	23	11.3N	114.9E	25	37	106	161	192				0	0	-5	-10						
00120318	24	11.0N	114.3E	25	31	83	131	163				0	0	-10	-10						
00120400	25	10.4N	114.2E	25	35	43	70					0	-5	-10							
00120512	26	9.1N	112.6E	30	18	30	67	93	110	65		5	0	0	-5	0	-5				
00120518	27	9.2N	112.2E	30	21	44	72	110	101	97		5	0	0	0	0	-5				
00120600	28	9.3N	111.8E	35	21	51	72	78	77			0	5	0	0	0	0				
00120606	29	9.5N	111.2E	35	29	47	89	92	89			0	5	5	0	0	-5				
00120612	30	9.7N	110.6E	30	16	48	66	83	78			5	5	5	5	-5					
00120618	31	9.8N	109.8E	30	13	17	25	76	158			0	5	0	-5	-5					
00120700	32	9.8N	109.0E	30	21	13	44	93				0	0	0	-5						

Statistics for JTWC on TS 33W Rumbia																	
00120706	33	9.7N	108.1E	25	0	45	69	119			0	0	-5	-5			
00120712	34	9.5N	107.6E	25	0	30	73	160			0	5	-5	5			
00120718	35	9.0N	106.9E	25	31	63	106			0	-5	-10					
00120800	36	8.6N	106.3E	20	0	32	107			0	-5	0					
00120806		8.1N	105.8E	25													
00120812		7.8N	105.5E	25													
00120818		7.5N	105.2E	25													
00120900		7.2N	105.2E	15													
00120906		6.8N	105.3E	20													
		AVERAGE		17	54	89	121	135	156	146	93	3	4	6	9	11	16
		BIAS										1	1	3	4	1	4
		# CASES		36	36	36	33	28	23	1	1	36	36	36	33	28	23
															1	1	

Statistics for JTWC on TY 34W Soulik																	
DTG	NO.	WRN BEST TRACK		POSITION ERRORS						WIND ERRORS						96	120
		LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48
00122818		7.0N	130.2E	20													
00122900	1	7.6N	130.4E	25	13	89	129	167	181	342		0	5	0	-5	-5	-15
00122906	2	8.3N	130.5E	25	45	56	136	164	122	79		0	5	0	0	5	-10
00122912	3	9.3N	130.2E	25	18	88	156	150	96	112		5	0	-5	0	5	-5
00122918	4	9.9N	129.3E	30	8	74	84	46	44	171		0	-5	-10	-5	0	-15
00123000	5	10.4N	128.6E	35	0	32	21	24	100	221		0	-5	-5	-5	0	-10
00123006	6	11.0N	127.8E	40	24	89	158	210	255	300		-5	-10	-10	-10	0	-10
00123012	7	11.6N	127.5E	45	34	100	185	249	285	305		0	-5	-10	-10	5	-10
00123018	8	12.1N	127.6E	50	13	8	66	140	208	230		0	0	0	5	15	-10
00123100	9	12.7N	128.2E	50	16	84	162	214	252	307		5	0	0	10	15	-20
00123106	10	13.3N	128.8E	55	13	90	172	227	226	276		0	-5	0	10	15	-45
00123112	11	13.9N	129.7E	55	8	71	130	181	193	255		0	0	10	15	15	-60
00123118	12	14.4N	130.6E	60	13	52	107	112	106	160		-5	-10	-10	-15	-25	-85
01010100	13	14.7N	131.6E	60	13	42	66	92	102	170		-5	-5	-5	-15	-35	-75
01010106	14	15.0N	132.4E	60	11	64	74	94	125	241		-5	-5	-5	-20	-60	-65
01010112	15	15.1N	133.2E	55	36	78	115	157	218	304		0	0	-5	-30	-75	-45
01010118	16	15.3N	134.0E	55	13	29	57	91	141	318		0	-5	-20	-60	-85	-35
01010200	17	15.6N	134.4E	50	13	21	31	91	136			5	-5	-30	-80	-80	
01010206	18	15.9N	134.7E	50	0	17	12	0	27			-5	-20	-65	-90	-70	
01010212	19	16.3N	134.9E	50	11	24	21	23				-5	-30	-80	-80		
01010218	20	16.7N	135.0E	55	0	46	118	206				-10	-55	-85	-70		
01010300	21	17.2N	135.3E	65	11	29	74	136	212			-10	-55	-55	-40	-5	
01010306	22	17.5N	135.6E	90	0	17	43	161	405			15	5	0	0	15	
01010312	23	17.8N	135.9E	105	6	21	79	283				10	15	20	30		
01010318	24	18.1N	136.2E	110	0	26	120	350				5	10	20	30		
01010400	25	18.3N	136.7E	100	5	40	232					0	5	25			
01010406	26	18.3N	137.0E	90	8	97	323					0	20	30			
01010412	27	18.0N	137.2E	70	18	202						-5	20				
01010418	28	16.9N	137.0E	55	71	291						-5	10				
01010500	29	15.3N	135.7E	25	16							0					
01010506		14.4N	134.0E	20													
		AVERAGE		15	67	111	149	172	237			4	11	19	26	27	32
		BIAS										-1	-4	-11	-18	-18	-32
		# CASES		29	28	26	24	20	16			29	28	26	24	20	16

Statistics for JTWC on TC 01B																				
WRN BEST TRACK				POSITION ERRORS								WIND ERRORS								
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00101412		14.8N	89.9E	25																
00101418		14.7N	89.0E	25																
00101500		14.6N	88.4E	25																
00101506		14.5N	87.7E	25																
00101512		14.4N	87.1E	25																
00101518		14.3N	86.5E	25																
00101600	1	14.2N	86.0E	35	23	42	65	94	115				0	0	10	15	20			
00101612	2	14.1N	85.1E	35	0	17	39	52	58				0	0	15	15	25			
00101700	3	14.0N	84.4E	35	16	18	32	54				0	5	15	20					
00101712	4	14.1N	83.9E	30	6	21	31					0	0	5						
00101800	5	14.6N	83.4E	30	5	17						5	10							
00101812	6	15.1N	82.7E	25	25							0								
00101818		15.3N	82.0E	25																
		AVERAGE			13	23	42	67	87				1	3	11	17	23			
		BIAS											1	3	11	17	23			
		# CASES			6	5	4	3	2				6	5	4	3	2			

Statistics for JTWC on TC 02B																				
WRN BEST TRACK				POSITION ERRORS								WIND ERRORS								
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00102512		14.9N	90.7E	25																
00102518		15.9N	90.1E	30																
00102600		16.6N	89.3E	30																
00102606		16.6N	88.6E	30																
00102612		16.5N	87.9E	30																
00102618		17.0N	87.7E	30																
00102700		18.0N	87.7E	30																
00102706		18.7N	87.9E	30																
00102712		19.7N	88.2E	30																
00102718	1	20.7N	88.5E	35	25	176							0	20						
00102806	2	23.7N	90.4E	20	32								0		20					
		AVERAGE			29	176							0	20						
		BIAS											0	20						
		# CASES			2	1							2	1						

Statistics for JTWC on TC 03B																				
WRN BEST TRACK				POSITION ERRORS								WIND ERRORS								
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00112612	1	9.3N	90.3E	35	26	46	75	112	112				0	10	10	5	-5			
00112700	2	10.3N	88.1E	35	59	94	118	142	120				0	0	0	-10	-10			
00112712	3	11.0N	85.8E	45	0	17	34	30	19				0	-5	-15	-15	-10			
00112800	4	11.4N	83.7E	55	13	27	40	56	59				0	-5	0	-10	-10			
00112812	5	11.5N	81.9E	70	16	24	25	43	51				-5	-10	10	5	0			
00112900	6	11.5N	80.8E	75	6	61	83	66	40				-10	5	5	0	5			
00112912	7	11.6N	79.7E	65	13	54	59	59	24				0	20	10	5	10			
00113000	8	11.4N	77.9E	45	31	71	118	106	101				0	0	5	10	15			
00113012	9	11.5N	76.5E	35	8	8	19						-5	-5	0					

Statistics for JTWC on TC 03B														
00120100	10	11.7N	74.9E	30	24	65	67				0	5	-5	
00120106	11	11.8N	74.2E	30	21	30	38				0	0	-5	
00120306	12	11.2N	66.7E	35	5	34	76	123	149	401	0	5	10	20
00120318	13	10.8N	64.4E	30	0	6	8	37	48		0	5	10	5
00120406	14	10.3N	61.9E	30	11	24	21	21	25		0	10	10	5
00120418	15	9.6N	59.4E	25	0	19	21				0	0	0	
00120506	16	9.2N	57.2E	25	18	43					0	-5		
00120512		8.8N	56.2E	25										
00120518		8.5N	55.3E	25										
00120600		8.1N	54.5E	25										
00120606		7.6N	53.5E	25										
00120612		7.1N	52.6E	25										
		AVERAGE		16	39	53	72	68	401		1	6	6	8
		BIAS									-1	2	3	2
		# CASES		16	16	15	11	11	1		16	16	15	11
														1

Statistics for JTWC on TC 04B																			
DTG	NO.	WRN BEST TRACK		POSITION ERRORS							WIND ERRORS								
		LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96
00122306		7.3N	85.4E	30															
00122312		7.6N	85.0E	30															
00122318		7.7N	84.6E	30															
00122400		7.8N	84.3E	30															
00122406		7.9N	84.1E	30															
00122412		7.9N	83.9E	30															
00122418		8.0N	83.8E	35															
00122500		8.1N	83.7E	40															
00122506	1	8.2N	83.6E	45	5	17	56	104	133		-5	-10	-10	-5	-10				
00122518	2	8.4N	83.0E	55	29	77	137	155	155		0	0	5	15	5				
00122606	3	8.6N	81.8E	60	13	19	17	59	145		5	-10	10	20	35				
00122618	4	8.3N	80.3E	60	13	55	124	223			-5	-5	15	35					
00122706	5	8.1N	79.2E	55	16	51	155				-5	5	30						
00122718	6	8.2N	78.4E	45	8	48					0	15							
00122806	7	8.5N	77.7E	30	8						5								
		AVERAGE		14	44	98	135	144			4	8	14	19	17				
		BIAS									-1	-1	10	16	10				
		# CASES		7	6	5	4	3			7	6	5	4	3				

### 5.3 SOUTHERN HEMISPHERE VERIFICATION TABLES

This section includes this year's verification statistics for each Southern Hemisphere tropical cyclone warned on by JTWC.

Statistics for JTWC on TC 01S Ilsa																					
WRN BEST TRACK				POSITION ERRORS								WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120	
99121000		9.4S	97.4E	20																	
99121006		9.6S	97.9E	20																	
99121012		9.8S	98.3E	25																	
99121018	1	10.1S	99.0E	30	11	19	65	82	100				0	-5	-5	-10	-5				
99121106	2	10.8S	100.2E	35	5	25	38	46	80				0	0	0	10	5				
99121118	3	11.6S	101.5E	40	0	13	21	55	85				0	0	10	0	-5				
99121206	4	12.1S	102.5E	45	0	6	38	61	98				0	5	0	0	0				
99121218	5	12.4S	103.5E	45	6	38	64	95	105				0	-5	0	0	-5				
99121306	6	12.4S	105.0E	55	8	8	34	46	69				-5	-5	-5	-5	-5				
99121318	7	12.4S	106.6E	55	0	21	42	69	88				-5	-5	-5	-5	-5				
99121406	8	12.1S	108.4E	55	0	12	50	96	190				0	-5	-15	-10	5				
99121418	9	12.0S	110.1E	55	6	30	51	130	195				0	-5	-5	15	25				
99121506	10	12.5S	112.4E	60	6	8	81	121	147				0	5	25	40	65				
99121518	11	13.7S	114.5E	60	8	78	121	141					0	20	30	70					
99121600	12	15.0S	116.0E	60	33	103	127	173					0	25	25	50					
99121606	13	16.1S	117.3E	50	0	12	90						0	-5	5						
99121612	14	17.3S	118.5E	45	5	67	132						0	-15	-5						
99121618	15	18.4S	119.3E	50	12	66							5	10							
99121700	16	19.2S	120.0E	55	12	73							-5	5							
99121706	17	20.0S	120.8E	35	8								0								
99121712	18	20.8S	121.8E	30	24								-5								
		AVERAGE			8	36	68	93	116				1	8	10	18	13				
		BIAS											-1	1	4	13	8				
		# CASES			18	16	14	12	10				18	16	14	12	10				

Statistics for JTWC on TC 02S John																				
WRN BEST TRACK				POSITION ERRORS								WIND ERRORS								
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
99121006		13.3S	119.4E	25																
99121012		12.9S	119.4E	25																
99121018		12.6S	119.7E	25																
99121100		12.6S	120.1E	25																
99121106		12.9S	120.2E	25																
99121112		13.1S	120.0E	25																
99121118	1	13.6S	119.6E	35	11	18	52	48	58				0	-10	-20	-30	-55			
99121206	2	14.5S	119.2E	50	11	40	60	68	68	131			0	-10	-15	-35	-40	-65		
99121218	3	15.5S	119.1E	65	6	21	27	35	60	186			0	-5	-30	-35	-45	50		
99121300	4	16.2S	118.9E	70	5	29	31	51	61				0	-15	-35	-45	-45			
99121306	5	16.7S	118.4E	80	8	35	48	37	61				-5	-30	-40	-55	-65			
99121312	6	17.2S	118.2E	90	0	6	12	33	79				0	-15	-25	-40	-25			
99121318	7	17.7S	118.0E	110	0	13	31	74	169				0	-10	-30	-25	25			
99121400	8	18.2S	117.7E	115	0	18	41	111					0	-10	-25	-5				
99121406	9	18.8S	117.5E	120	5	19	57	126					0	-5	-5	20				
99121412	10	19.6S	117.3E	130	6	11	66						0	0	20					

Statistics for JTWC on TC 02S John																				
99121418	11	20.2S	117.3E	130	6	40	118					0								
99121500	12	20.9S	117.6E	130	6	39					0	10								
99121506	13	21.6S	118.0E	115	5	74					0	45								
99121512	14	22.2S	118.7E	80	8					0										
99121518			23.0S	119.6E	30															
				AVERAGE	6	28	49	65	79	159	0	13	25	32	43	58				
				BIAS									0	-4	-16	-28	-36	-8		
				# CASES	14	13	11	9	7	2	14	13	11	9	7	2				

Statistics for JTWC on TC 03S Astride																				
	WRN	BEST TRACK			POSITION ERRORS				WIND ERRORS											
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
99122312		9.1S	75.6E	20																
99122318		9.9S	75.0E	20																
99122400		10.5S	74.4E	25																
99122406		11.2S	73.8E	25																
99122412		11.9S	72.9E	25																
99122418		12.1S	72.0E	25																
99122500	1	12.3S	70.9E	30	18	90	109	124	169					0	-15	-15	-15	-10		
99122512	2	12.5S	69.0E	45	8	25	18	34	37					0	5	10	20	20		
99122600	3	13.1S	66.9E	50	0	6	18	44	66					0	5	15	10	15		
99122612	4	13.5S	64.7E	55	0	17	23	47	52					0	5	5	10	25		
99122700	5	14.2S	63.0E	55	6	19	38	50	81					0	-5	5	20	25		
99122712	6	14.5S	61.3E	65	6	25	32	35	63					0	5	20	25	30		
99122800	7	14.8S	59.7E	65	13	25	30	52	118					0	10	15	15	25		
99122812	8	15.1S	57.9E	55	8	26	72	100	113					0	0	5	20	25		
99122900	9	15.4S	56.7E	55	40	31	25	76	101					0	0	5	0	-5		
99122912	10	15.5S	55.7E	55	23	42	83	114	171					0	5	0	0	-5		
99123000	11	15.3S	54.6E	45	5	12	31	71	106					0	-5	-5	-20	-5		
99123012	12	14.8S	53.3E	45	0	6	29	32						0	0	-5	-20			
99123100	13	14.1S	51.7E	40	0	30	13							0	0	-15				
99123112	14	13.4S	50.7E	40	0	12	18							0	-5	-10				
00010100	15	12.8S	49.0E	40	0	12								0	-5					
00010112	16	12.7S	47.2E	35	13	23								0	0					
00010118		12.7S	46.5E	25																
00010200		12.7S	45.8E	25																
00010206		12.8S	45.0E	25																
00010212		12.9S	44.0E	25																
00010218		13.0S	42.5E	25																
00010300		13.1S	40.9E	25																
		AVERAGE		9	25	38	65	98						0	4	9	15	17		
		BIAS												0	0	2	5	13		
		# CASES		16	16	14	12	11						16	16	14	12	11		

Statistics for JTWC on TC 04S Babiola												
	WRN	BEST TRACK			POSITION ERRORS				WIND ERRORS			
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120
00010306		12.8S	82.4E	25								
00010312		12.9S	82.1E	25								
00010318		12.9S	81.8E	25								

Statistics for JTWC on TC 04S Babiola																	
00010400		12.6S	81.6E	30													
00010406		12.3S	81.7E	30													
00010412		11.8S	82.2E	25													
00010418		11.3S	82.8E	25													
00010500		10.9S	83.3E	25													
00010506		11.2S	83.6E	30													
00010512		11.7S	83.6E	30													
00010518	1	12.1S	82.9E	35	8	21	30	21	55			0	0	10	15	15	
00010606	2	13.0S	81.6E	45	8	30	13	18	34			0	10	15	15	15	
00010618	3	14.2S	80.4E	45	13	64	88	104	120			0	5	10	5	-5	
00010706	4	15.0S	78.2E	50	21	29	59	84	91			0	0	0	-5	0	
00010718	5	15.6S	75.9E	55	5	25	25	38	83			0	-10	-10	-5	-15	
00010806	6	16.4S	73.4E	65	11	17	8	80	209			0	0	10	0	10	
00010818	7	17.1S	70.9E	75	5	13	74	146	197			0	5	-5	0	35	
00010906	8	17.9S	68.8E	75	16	52	140	244	328			0	-5	5	40	70	
00010918	9	19.4S	67.6E	90	5	25	63	98	165			0	5	40	70	80	
00011006	10	20.8S	67.2E	90	11	51	36	128	204			0	25	40	40	30	
00011018	11	22.6S	67.5E	65	5	54	71	99				0	10	10	5		
00011106	12	23.9S	68.2E	45	16	52	97					0	0	-5			
00011118	13	25.6S	68.8E	35	11	8						0	-5				
00011206	14	27.9S	70.1E	35	8							-10					
00011212		28.9S	71.7E	30													
		AVERAGE			11	34	59	96	149			1	6	13	18	28	
		BIAS										-1	3	10	16	24	
		# CASES			14	13	12	11	10			14	13	12	11	10	

Statistics for JTWC on TC 05P Iris																				
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS									
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00010600		14.6S	164.1E	15																
00010606		14.7S	164.2E	20																
00010612		14.9S	164.3E	20																
00010618		15.1S	164.3E	25																
00010700		15.4S	164.3E	25																
00010706		16.0S	164.4E	25																
00010712		16.3S	164.9E	25																
00010718	1	16.3S	165.5E	20	0	8	25	48	97			20	-25	-20	-10	5				
00010806	2	16.6S	166.6E	70	5	29	97	195	287			-5	10	25	35	40				
00010818	3	17.0S	168.2E	65	0	29	60	95				0	-5	0	0					
00010906	4	17.6S	170.8E	60	6	70	177					5	20	20						
00010918	5	18.5S	174.1E	45	12	67						0	5							
00011006	6	19.3S	177.4E	35	17							0								
		AVERAGE			7	41	90	113	192			5	13	16	15	23				
		BIAS										3	1	6	8	23				
		# CASES			6	5	4	3	2			6	5	4	3	2				

Statistics for JTWC on TC 06S																				
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS									
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00011818		11.1S	126.9E	25																

Statistics for JTWC on TC 06S															
00011900		11.4S	126.1E	25											
00011906		11.7S	125.1E	25											
00011912		12.3S	124.0E	25											
00011918		12.7S	123.0E	25											
00012000		13.4S	121.6E	25											
00012006		14.3S	120.2E	25											
00012012		15.3S	118.5E	25											
00012018		16.0S	117.1E	25											
00012100	1	16.4S	116.4E	30	0	12	38	135	192		0	0	5	10	0
00012106	2	16.9S	115.8E	30	5	74	131	250	361		-5	0	5	0	5
00012112	3	17.5S	115.5E	30	24	111	204	342			-5	0	5	-5	
00012118	4	17.9S	115.5E	30	23	26	115	207			0	0	5	5	
00012200	5	18.5S	115.5E	30	5	46	159				0	5	10		
00012206	6	18.9S	115.6E	30	11	74	153				5	5	15		
00012212	7	19.2S	116.1E	30	5	33					0	5			
00012218	8	19.9S	116.9E	30	11	71					0	5			
00012300	9	20.7S	117.7E	25	12						0				
00012306		21.5S	118.5E	20											
		AVERAGE			11	56	133	233	276		2	3	8	5	3
		BIAS									-1	3	8	3	3
		# CASES			9	8	6	4	2		9	8	6	4	2

Statistics for JTWC on TC 07P Jo																				
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS									
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00012300		14.5S	171.7E	25																
00012306		15.2S	172.3E	25																
00012312		16.1S	172.6E	30																
00012318		17.0S	172.8E	30																
00012400	1	17.8S	173.1E	40	17	13	72	149	272		0	0	0	-5	0					
00012412	2	19.1S	173.5E	45	23	36	78	105	121		0	-5	-10	-5	0					
00012500	3	20.4S	174.3E	50	17	29	33	99	181		0	-15	-20	-25	-35					
00012512	4	21.6S	175.1E	60	13	42	65	96	157		5	-5	-15	-25	-5					
00012600	5	23.0S	176.7E	60	11	19	8	50	148		5	-5	-15	0	5					
00012612	6	25.4S	178.9E	60	10	30	75	140			5	-5	10	10						
00012700	7	27.4S	178.3W	60	13	62	105				0	20	20							
00012706		28.2S	176.6W	55																
00012712		29.2S	173.9W	35																
00012718		30.2S	171.0W	30																
00012800		31.4S	168.1W	25																
00012806		32.8S	164.7W	25																
		AVERAGE			15	33	62	107	176		2	8	13	12	9					
		BIAS									2	-2	-4	-8	-7					
		# CASES			7	7	7	6	5		7	7	7	6	5					

Statistics for JTWC on TC 08S Connie																				
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS									
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00012500		15.2S	56.2E	20																
00012506		15.1S	56.0E	25																

Statistics for JTWC on TC 08S Connie																	
00012512		15.0S	55.8E	25													
00012518	1	14.8S	55.7E	35	64	84	156	223	290	383		0	10	0	0	-35	-25
00012600	2	14.6S	55.6E	35	26	59	113	162	214	206		0	-5	-5	-25	-45	-15
00012606	3	14.5S	55.6E	35	37	71	101	135	158	131		0	-10	-10	-55	-35	-10
00012612	4	14.4S	55.7E	45	13	52	92	134	166	120		0	-5	-20	-45	-20	15
00012618	5	14.4S	55.9E	55	25	61	88	109	105	109		0	0	-40	-25	-10	20
00012700	6	14.7S	56.2E	60	26	50	81	93	72	132		0	-20	-45	-25	0	30
00012706	7	15.1S	56.4E	65	6	12	24	26	21	128		0	-40	-20	-5	15	50
00012712	8	15.5S	56.6E	85	0	17	46	54	41	160		0	-25	0	20	40	35
00012718	9	15.9S	56.8E	115	23	61	91	78	66	210		0	15	25	40	40	35
00012800	10	16.3S	57.0E	120	18	44	60	51	98	257		0	15	35	50	50	35
00012806	11	16.7S	57.0E	110	8	13	47	86	159	216		0	20	40	40	35	25
00012812	12	17.1S	57.0E	110	0	29	56	101	170	171		0	30	45	50	35	25
00012818	13	17.6S	56.6E	105	6	45	112	114	162	191		0	15	30	40	15	0
00012900	14	18.1S	56.1E	95	8	64	130	230	200	130		0	5	5	0	-5	-10
00012906	15	19.0S	55.4E	90	13	25	73	104	92	39		0	5	10	0	5	5
00012912	16	19.9S	54.7E	80	6	33	114	117	139	138		0	0	-5	-15	-15	0
00012918	17	20.9S	53.8E	80	0	34	84	109	108	73		0	5	-5	-5	-25	0
00013000	18	22.0S	53.0E	70	16	73	95	117	78	53		0	0	-15	-15	-25	10
00013006	19	23.2S	51.8E	65	0	27	43	69	73			0	-5	-5	-25	-10	
00013018	20	25.2S	50.2E	65	0	50	77	87	72			-5	-5	-25	-10	0	
00013106	21	27.6S	50.4E	55	6	20	39	54	45			0	-15	-5	0	5	
00013118	22	29.7S	51.3E	65	0	35	56	93				0	10	10	10		
00020106	23	31.3S	52.3E	45	0	65	134					10	10	15			
00020118	24	32.2S	53.2E	35	7	16						0	5				
00020206	25	33.4S	54.5E	25	0							0					
00020212		34.4S	56.0E	25													
		AVERAGE			13	43	83	107	120	158		1	11	18	23	22	19
		BIAS										0	1	1	0	1	13
		# CASES			25	24	23	22	21	18		25	24	23	22	21	18

Statistics for JTWC on TC 09S Kirrily																		
DTG	NO.	WRN BEST TRACK		POSITION ERRORS						WIND ERRORS								
		LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72
00012412		11.8S	102.6E	25														
00012418		12.0S	103.2E	20														
00012500		12.3S	104.0E	20														
00012506		12.6S	105.3E	25														
00012512		12.8S	106.1E	25														
00012518		13.0S	106.9E	25														
00012600		13.5S	108.4E	25														
00012606		14.1S	109.8E	25														
00012612		14.9S	110.7E	25														
00012618		15.7S	111.6E	25														
00012700		16.4S	112.3E	25														
00012706	1	17.1S	112.4E	30	12	47	121	153	117		0	0	-15	-30	-40			
00012718	2	18.2S	111.8E	30	20	99	115	115	135		5	-10	-20	-30	-30			
00012806	3	18.5S	110.1E	50	24	29	48	72	115		5	0	-5	5	20			
00012818	4	19.2S	108.8E	65	8	72	132	187	183		-5	-15	-5	15	35			
00012906	5	20.3S	107.5E	80	8	16	42	70	85		0	10	25	40	60			
00012918	6	21.4S	106.5E	75	13	21	61	97	173		-5	-10	-10	0	-10			
00013006	7	22.6S	105.8E	65	18	37	66	116	144		0	0	10	0	-5			

Statistics for JTWC on TC 09S Kirrily												
00013018	8	23.3S	105.6E	55	26	53	119					-5
00013106	9	23.4S	105.3E	35	6	58	97					0
00013118	10	22.9S	105.0E	35	5	33	45					0
00020106	11	22.4S	104.1E	30	0	18						0
00020118	12	21.9S	102.9E	25	5							0
				AVERAGE	13	44	85	116	136		2	5
				BIAS						0	-3	-5
				# CASES	12	11	10	7	7		12	11
										7	7	

Statistics for JTWC on TC 10S Damienne																				
	WRN	BEST	TRACK	POSITION ERRORS							WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00013018		11.1S	73.7E	20																
00013100		11.4S	74.3E	20																
00013106		11.7S	74.9E	25																
00013112		12.0S	75.6E	25																
00013118		12.5S	76.3E	25																
00020100		13.0S	77.0E	30																
00020106		13.8S	77.9E	25																
00020112		14.8S	78.3E	25																
00020118	1	15.5S	78.1E	45	37	89	80	81					0	20	40	55				
00020206	2	16.1S	77.0E	35	8	34	71					5	15	20						
00020218	3	17.3S	76.1E	25	0	86						0	-5							
00020300		17.6S	74.8E	25																
00020306		18.2S	72.9E	25																
00020312		18.8S	71.5E	25																
		AVERAGE		15	69	75	81					2	13	30	55					
		BIAS										2	10	30	55					
		# CASES		3	3	2	1					3	3	2	1					

Statistics for JTWC on TC 11S Leone-Eline																				
	WRN	BEST	TRACK	POSITION ERRORS							WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00020300		11.0S	110.4E	25																
00020306		11.2S	109.6E	25																
00020312		11.5S	108.7E	25																
00020318		11.8S	107.9E	25																
00020400	1	12.1S	107.1E	30	0	42	35	51	96				0	0	-15	-5	0			
00020412	2	13.2S	105.4E	35	18	29	30	59	98				0	-15	-10	-5	-5			
00020500	3	14.0S	104.2E	55	0	6	13	46	29				-5	0	0	-5	-5			
00020512	4	14.8S	102.8E	55	0	6	17	6	38				0	0	-10	-15	-10			
00020600	5	15.9S	101.6E	60	0	12	19	66	60				0	-5	-5	-10	5			
00020612	6	17.0S	99.8E	70	8	50	104	117	177				0	10	10	15	20			
00020700	7	17.6S	98.1E	70	18	60	88	154	123	136			0	5	15	20	15	15		
00020706	8	17.7S	97.1E	65	24	80	134	197	186	270			0	10	15	15	10	5		
00020712	9	17.6S	96.0E	65	47	69	143	147	168	289			0	10	15	10	5	10		
00020718	10	17.5S	94.6E	55	42	49	91	55	51	127			0	5	5	0	0	0		
00020800	11	17.9S	93.1E	50	18	67	48	18	62	76			0	5	0	-5	-10	-10		
00020806	12	17.5S	91.6E	45	16	25	21	18	33				0	0	-5	-10	-15	-15		
00020812	13	17.2S	90.3E	40	5	48	101	85	53				0	-5	-10	-15	-15	-15		

Statistics for JTWC on TC 11S Leone-Eline																	
00020818	14	17.0S	89.0E	40	18	56	105	104	69	54		-5	-5	-5	-5	0	5
00020900	15	17.5S	87.6E	40	29	93	116	100	67	34		-5	-5	-5	0	0	0
00020906	16	17.8S	86.0E	40	18	59	58	25	23	67		5	5	5	15	20	25
00020912	17	18.3S	84.3E	40	11	47	25	40	42			0	0	5	15	20	
00021000	18	18.2S	80.7E	40	5	37	92	106	143			0	5	5	0	-5	
00021012	19	17.9S	77.9E	35	8	30	59	104				0	0	-5	-15		
00021100	20	17.6S	75.3E	35	0	37	24	51				0	0	-10	-20		
00021112	21	17.5S	72.0E	35	11	58	147	207				-5	-10	-20	-25		
00021200	22	16.9S	69.2E	40	8	39	73	111	173			0	-5	0	-5	-20	
00021212	23	16.3S	67.2E	45	12	32	12	114	207			0	0	0	-15	-10	
00021300	24	15.8S	64.7E	45	16	47	126	191	248			0	-5	-20	-15	-15	
00021312	25	16.0S	62.6E	50	6	34	74	139	218			0	-20	-15	-10	0	
00021400	26	17.0S	60.9E	70	0	25	30	51	72			0	10	15	25	30	
00021412	27	17.9S	58.9E	70	24	62	107	136	169			0	-5	-10	-20	-20	
00021500	28	18.5S	57.2E	70	8	13	36	40	98			0	0	-5	-10	-15	
00021512	29	19.1S	55.6E	65	6	32	19	36	94			0	0	-5	-10	-30	
00021600	30	20.0S	54.1E	65	0	18	54	92	132			0	-5	-10	-30	-25	
00021612	31	20.4S	52.2E	65	8	53	73	126	156			0	-5	-30	-30	-5	
00021700	32	20.1S	50.9E	65	11	34	90	171	233			0	-20	-15	5	-15	
00021712	33	19.9S	49.5E	80	6	66	90	79	54			0	0	15	-10	-10	
00021800	34	19.2S	47.5E	65	16	63	84	62	34			0	15	5	0	-15	
00021812	35	19.4S	45.1E	30	17	41	84	139	172			0	-5	0	0	-5	
00021900	36	20.2S	43.2E	35	6	25	45	35	81			0	10	10	5	0	
00021912	37	20.9S	41.9E	35	0	13	47	84	142			0	0	0	-5	-5	
00022000	38	21.9S	40.5E	45	12	47	84	132	158			0	-5	-10	-10	-55	
00022012	39	22.1S	38.7E	55	47	89	144	190				0	0	-25	-70		
00022100	40	21.9S	37.4E	65	16	56	93	85				0	0	-45	-55		
00022112	41	21.4S	36.6E	70	5	29	45	132				0	-30	-35	-15		
00022200	42	20.8S	35.7E	100	8	57	130	176				-5	5	5	-5		
00022212	43	20.4S	34.1E	90	12	107	184					10	30	20			
00022300	44	19.5S	31.7E	45	11	31						0	5				
00022306		19.2S	30.7E	30													
00022312		18.8S	29.7E	25													
		AVERAGE		13	45	74	97	113	132			1	6	11	14	12	9
		BIAS										0	0	-4	-8	-5	6
		# CASES		44	44	43	42	35	8			44	44	43	42	35	8

Statistics for JTWC on TC 12S Felicia																	
DTG	NO.	WRN BEST TRACK		POSITION ERRORS						WIND ERRORS							
		LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48
00021818		13.3S	78.4E	25													
00021900		13.6S	78.1E	25													
00021906		13.8S	77.8E	25													
00021912		14.1S	77.5E	25													
00021918		14.5S	77.1E	25													
00022000		15.0S	76.6E	30													
00022006		15.3S	76.1E	30													
00022012		15.7S	75.5E	30													
00022018		16.1S	74.8E	30													
00022100	1	16.5S	74.1E	35	13	31	126	242	372			0	5	0	5	0	
00022112	2	17.8S	72.4E	35	32	108	211	336	467			0	-5	-5	-10	25	
00022200	3	19.6S	70.0E	45	33	125	230	355	512			0	0	-10	25	45	

Statistics for JTWC on TC 12S Felicia														
00022212	4	21.8S	68.1E	50	16	40	98	179		-5	-15	15	35	
00022300	5	24.3S	66.5E	65	29	48	106			-15	10	20		
00022312	6	26.8S	65.6E	40	10	36				0	5			
00022400	7	29.1S	64.8E	30	12					0				
00022406		30.2S	63.7E	25										
		AVERAGE		21	64	154	278	450		3	7	10	19	23
		BIAS								-3	0	4	14	23
		# CASES		7	6	5	4	3		7	6	5	4	3

Statistics for JTWC on TC 13S																				
	WRN	BEST	TRACK		POSITION ERRORS					WIND ERRORS										
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00022312		23.2S	132.8W	20																
00022318		23.2S	133.6W	25																
00022400		23.2S	134.5W	30																
00022406	1	23.2S	135.1W	30	18															
00022418	2	23.2S	135.7W	45	0															
00022506	3	23.3S	136.4W	55	0															
00022518	4	24.2S	137.6W	65	12															
00022606	5	24.7S	139.2W	100	0															
00022618	6	26.5S	141.0W	75	36															
00022706	7	28.0S	142.8W	75	27															
00022718	8	29.3S	145.2W	65	12															
00022806	9	31.0S	147.7W	35	0															
00022818	10	32.5S	149.3W	35	0															
00022906	11	34.3S	150.5W	30	0															
00022918	12	35.7S	152.3W	30	24															
00030100		36.4S	152.9W	25																
		AVERAGE		11																
		BIAS																		
		# CASES		12																

Statistics for JTWC on TC 14P Steve																		
	WRN	BEST	TRACK		POSITION ERRORS					WIND ERRORS								
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00					
00022506		16.5S	150.7E	25														
00022512		16.5S	150.4E	25														
00022518		16.5S	150.1E	25														
00022600		16.5S	149.8E	25														
00022606		16.5S	149.2E	25														
00022612		16.5S	148.6E	30														
00022618	1	16.5S	147.9E	35	23	19	13	57		0	0	-5	-5					
00022706	2	16.5S	145.8E	40	31	59	81	81		0	5	0	-5					
00022718	3	17.0S	143.7E	30	41	82	60	41	6		0	0	10					
00022806	4	17.6S	141.7E	25	49	141					0	-5						
00022818	5	16.9S	139.9E	25	11	24	0	39	89		0	5	0					
00022906	6	16.1S	138.5E	35	24	60	75	120	160		0	-10	10					
00022918	7	15.7S	136.9E	45	42	88	100	147	172		0	25	20					
00030106	8	15.8S	135.4E	30	29	27					-5	-5						
00030218	9	14.7S	130.5E	25	8	79	129	142	145	222		0	5	5				
														10	15	5		

Statistics for JTWC on TC 14P Steve																	
00030300	10	15.0S	129.5E	25	16	67	86	91	85	120		0	5	0	0	0	-10
00030306	11	15.7S	128.5E	25	12	21	37	39	37	115		0	-5	-5	0	-5	-20
00030312	12	16.1S	127.3E	25	11	51	55	33	64	152		0	-5	0	0	0	-10
00030318	13	16.4S	126.0E	30	5	13	40	72	112	162		0	0	5	5	0	15
00030400	14	16.7S	124.9E	30	0	8	30	66	97	181		0	0	0	0	0	15
00030406	15	17.0S	123.8E	30	6	40	83	135	127	188		0	5	5	0	0	20
00030412	16	17.4S	122.8E	30	12	29	59	99	133	222		0	0	0	0	0	20
00030418	17	17.7S	121.9E	30	18	30	74	91	140	235		0	0	0	-5	15	20
00030500	18	18.1S	121.0E	35	20	32	69	95	159	191		0	5	10	5	20	15
00030506	19	18.7S	120.1E	40	16	58	72	112	149	148		0	-5	-5	15	20	20
00030512	20	19.1S	119.2E	45	0	27	48	122	127	177		0	0	0	20	25	25
00030518	21	19.9S	118.5E	55	0	23	57	94	96	149		0	-5	10	20	20	10
00030600	22	20.1S	117.7E	55	0	8	69	57	65	133		0	0	15	15	10	10
00030606	23	20.3S	116.9E	65	5	62	101	111	103	174		-5	10	15	15	15	10
00030612	24	20.8S	116.2E	65	11	68	62	86	105	211		0	15	15	10	10	0
00030618	25	21.6S	115.5E	55	0	23	34	63	136	317		0	0	0	0	-5	0
00030700	26	22.3S	115.2E	55	0	28	16	47	117	250		-5	-10	-10	-5	0	10
00030706	27	22.7S	114.5E	55	0	25	65	111	173	335		-5	-10	-5	-5	-10	-10
00030712	28	23.0S	113.9E	55	18	37	69	110	149	247		-5	-5	-5	0	-15	-5
00030718	29	23.6S	113.6E	55	6	25	69	119	145	283		0	15	10	15	15	15
00030800	30	24.1S	113.3E	55	13	19	60	106	179	313		0	10	20	10	20	20
00030806	31	24.4S	113.1E	50	21	34	88	155	198			0	0	5	10	10	10
00030812	32	24.8S	113.1E	50	8	53	110	169	168			0	5	0	10	5	
00030900	33	25.4S	113.6E	45	8	12	37	48	35			0	-5	5	0	10	
00030912	34	25.9S	114.2E	50	0	69	184	258				0	10	5	5		
00031000	35	27.0S	116.1E	35	16	55	90					0	5	10			
00031012	36	29.0S	118.9E	30	0	70						0	5				
00031018		30.1S	120.1E	25													
00031100		32.0S	121.2E	20													
		AVERAGE			14	44	67	97	120	206		1	6	6	6	9	13
		BIAS										-1	2	4	5	6	8
		# CASES			36	36	33	32	29	22		36	36	33	32	29	22

Statistics for JTWC on TC 15S Gloria																				
	WRN	BEST TRACK		POSITION ERRORS						WIND ERRORS										
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00022700		13.8S	62.5E	20																
00022706		13.8S	62.1E	25																
00022712		13.7S	61.4E	20																
00022718		13.6S	60.8E	25																
00022800		13.5S	60.0E	25																
00022806		13.3S	59.0E	30																
00022812	1	13.2S	58.4E	30	29	38	76	93	74				0	0	0	5	15			
00022900	2	12.8S	56.6E	35	11	63	95	71	58				0	-5	-5	5	25			
00022912	3	12.2S	54.2E	40	29	19	93	180	225				0	0	0	10	40			
00030100	4	12.6S	51.8E	45	40	110	200	278	302				0	-5	5	25	45			
00030106	5	12.9S	51.2E	50	6	30	92	131	176				5	15	20	35	40			
00030112	6	13.3S	50.7E	50	13	42	86	117	164	247			5	15	15	25	30	45		
00030118	7	13.7S	50.1E	50	24	38	63	116	158	245			15	15	10	10	20	40		
00030200	8	14.6S	49.6E	45	8	21	12	46	83	179			0	5	5	0	0	5		
00030206	9	15.3S	49.2E	30	0	29	12	59	118	283			0	5	0	0	5	10		
00030212	10	16.0S	48.7E	30	5	36	25	79	153	333			0	0	0	-5	10	15		

Statistics for JTWC on TC 15S Gloria																	
00030218	11	16.5S	47.8E	25	0	46	74	112	181		0	0	-5	0	10		
00030300	12	17.0S	47.2E	25	12	18	49	72	131		0	0	0	0	5		
00030306	13	17.5S	46.9E	25	24	67	99	153	213		0	0	5	10	10		
00030312	14	17.9S	46.5E	25	0	19	58	107	177		0	0	5	10	15		
00030318	15	18.2S	46.0E	25	8	8	64	140			0	0	5	10			
00030400	16	18.5S	45.4E	25	0	29	85	152			0	0	5	5			
00030406	17	18.9S	44.9E	25	8	21	41				0	0	5				
00030412	18	19.2S	44.6E	25	16	47	96				0	0	5				
00030418	19	19.6S	44.3E	25	18	32					0	0					
00030500	20	20.0S	44.0E	25	41	43					0	0					
00030506	21	20.3S	43.7E	25	34						0						
00030512		20.5S	43.5E	25													
		AVERAGE			16	38	73	119	158	258		1	3	5	10	19	23
		BIAS										1	2	4	9	19	23
		# CASES			21	20	18	16	14	5		21	20	18	16	14	5

Statistics for JTWC on TC 16S Norman																				
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS									
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00022912		18.6S	119.6E	25																
00022918		18.8S	118.6E	25																
00030100		18.5S	117.2E	25																
00030106	1	18.4S	116.3E	35	12	24	46	119	204		0	-15	-20	-40	-60					
00030118	2	18.4S	114.7E	55	37	8	18	46	88		0	0	-20	-35	-25					
00030206	3	19.0S	112.3E	65	8	21	33	78	67		0	-20	-30	-15	5					
00030218	4	19.5S	109.4E	95	6	16	54	48	88		0	-5	15	25	30					
00030306	5	19.7S	106.2E	120	5	41	6	51	154		0	5	5	10	30					
00030318	6	20.2S	102.4E	115	0	29	29	43	74		0	10	15	35	30					
00030406	7	20.3S	99.3E	105	28	71	144	221	324		0	15	35	30	25					
00030418	8	20.5S	96.7E	90	0	41	51	86	126		0	10	0	-5	-15					
00030506	9	20.4S	94.8E	65	8	21	63	114	189		0	0	-5	-10	-15					
00030518	10	20.4S	93.2E	65	8	29	86	155	290		0	0	-5	-5	-15					
00030606	11	20.7S	92.4E	65	0	61	122	247	304		0	0	0	-5	10					
00030618	12	22.0S	91.8E	65	6	17	111	151	274		0	0	-5	5	20					
00030706	13	23.1S	91.6E	60	0	72	106	201			0	-10	-10	5						
00030718	14	23.9S	92.7E	60	39	126	179				0	10	20							
00030806	15	23.9S	92.5E	45	0	111					0	10								
00030812		23.8S	93.0E	30																
00030818		23.9S	93.9E	25																
		AVERAGE			11	46	75	120	182		0	7	13	17	23					
		BIAS									0	1	0	0	2					
		# CASES			15	15	14	13	12		15	15	14	13	12					

Statistics for JTWC on TC 17S																				
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS									
		LAT	LONG	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120	
00022906		12.2S	85.8E	20																
00022912		12.3S	86.5E	20																
00022918		12.4S	87.2E	20																
00030100		12.6S	87.4E	25																

Statistics for JTWC on TC 17S															
00030106		13.0S	87.6E	30											
00030112	1	13.0S	87.4E	30	30	60	25	18	114		0	0	0	15	25
00030200	2	13.0S	86.8E	30	0	49	81	146	146		0	0	10	20	35
00030212	3	13.9S	86.2E	35	0	42	66	54	55		-5	5	10	20	25
00030300	4	14.6S	84.7E	30	18	88	91	126	179		0	0	10	20	25
00030312	5	15.9S	84.3E	30	16	31	38	67	148		0	5	10	15	20
00030400	6	16.0S	83.1E	25	8	6	36	118			0	0	-5	-5	
00030412	7	16.3S	82.1E	25	0	35	115	197	271		0	0	-5	-5	0
00030500	8	16.0S	81.2E	25	17	57					0		-5		
00030506		15.4S	80.8E	25											
00030512		15.0S	80.7E	25											
00030518		14.6S	80.6E	25											
00030600		14.3S	80.3E	25											
00030606		14.3S	80.3E	25											
00030612		14.3S	80.4E	20											
		AVERAGE			12	46	65	104	152		1	2	7	14	22
		BIAS									-1	1	4	11	22
		# CASES			8	8	7	7	6		8	8	7	7	6

Statistics for JTWC on TC 18S																					
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS										
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120	
00030400		19.6S	151.5W	20																	
00030406		19.7S	151.9W	20																	
00030412		19.8S	152.4W	20																	
00030418		20.0S	152.9W	25																	
00030500		20.3S	153.9W	25																	
00030506		21.2S	156.5W	25																	
00030512		21.7S	158.2W	25																	
00030518		22.4S	159.9W	25																	
00030600		23.1S	161.2W	25																	
00030606		23.8S	162.3W	25																	
00030612	1	24.4S	163.4W	25	0							20									
00030618	2	25.6S	165.2W	55	0							0									
00030706	3	29.5S	165.9W	30	0							0									
00030718	4	33.6S	166.6W	35	0							0									
00030806	5	39.9S	164.2W	30	0							0									
		AVERAGE			0							4									
		BIAS										4									
		# CASES			5							5									

Statistics for JTWC on TC 19S																					
DTG	NO.	WRN BEST TRACK		wind	POSITION ERRORS						WIND ERRORS										
		LAT	LONG		00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120	
00030712		17.9S	173.6W	25																	
00030718		18.6S	174.1W	25																	
00030800	1	19.2S	174.7W	30	33							5									
00030812	2	20.2S	175.4W	25	26							0									
00030818	3	20.8S	175.8W	55	0							0									
00030906	4	21.7S	176.0W	75	30							0									

Statistics for JTWC on TC 19S															
00030918	5	22.6S	175.4W	75	0	78	100	96			0	-15	10	20	
00031006	6	24.3S	173.3W	80	0						0				
00031018	7	26.3S	171.9W	45	65						0				
00031106	8	28.2S	171.9W	30	0						0				
		AVERAGE		19	78	100	96			1	15	10	20		
		BIAS								1	-15	10	20		
		# CASES		8	1	1	1			8	1	1	1		

Statistics for JTWC on TC 20S Olga																				
	WRN	BEST	TRACK		POSITION ERRORS						WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00031418		17.1S	118.6E	25																
00031500		17.2S	117.9E	25																
00031506		17.2S	117.0E	25																
00031512	1	16.9S	115.7E	25	12	48	91	126	117		0	10	25	30	30					
00031600	2	16.6S	114.6E	30	47	104	156	155	143		0	10	20	25	25					
00031612	3	16.5S	113.6E	30	13	35	73	108	168		0	0	-5	-5	0					
00031700	4	16.8S	112.8E	30	66	90	93	97	130		0	-5	-15	-5	10					
00031712	5	17.5S	111.2E	35	20	21	77	129	220		0	-10	-5	10	25					
00031800	6	18.3S	109.6E	45	22	58	84	126			0	5	20	30						
00031812	7	20.0S	107.8E	45	41	45	48				0	5	10							
00031900	8	21.1S	105.9E	35	5	78					0	5								
00031906	9	22.0S	105.2E	30	0	30					0	0								
00031912		23.1S	104.6E	25																
00031918		24.1S	104.1E	25																
		AVERAGE		26	56	89	124	156			0	6	14	18	18					
		BIAS									0	2	7	14	18					
		# CASES		9	9	7	6	5			9	9	7	6	5					

Statistics for JTWC on TC 21S Hudah																				
	WRN	BEST	TRACK		POSITION ERRORS						WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00032218		16.7S	101.9E	20																
00032300		16.6S	100.7E	20																
00032306		16.3S	99.3E	20																
00032312		16.1S	98.1E	20																
00032318		15.9S	96.8E	25																
00032400		15.7S	95.4E	25																
00032406		15.3S	94.1E	25																
00032412	1	15.3S	93.0E	30	5	19	27	42	74		0	0	-35	-25	-25					
00032500	2	15.3S	90.5E	35	11	42	35	50	80	68	0	-25	-10	0	0	-5				
00032506	3	15.3S	89.4E	55	17	59	117	169	227	287	0	5	25	15	-10	-45				
00032512	4	15.3S	88.2E	70	5	21	43	80	102	82	0	15	30	10	-15	-45				
00032518	5	15.1S	87.2E	65	11	6	26	88	128		0	0	-10	-30	-40					
00032606	6	14.9S	85.3E	65	0	13	21	18	35		0	0	-25	-40	-50					
00032618	7	14.6S	83.3E	65	5	47	81	90	107		0	-15	-25	-45	-50					
00032706	8	14.6S	81.7E	80	11	18	18	42	60		0	-10	-25	-30	-25					
00032718	9	14.7S	79.7E	90	0	18	27	53	79		0	-5	0	0	-5					
00032800	10	14.8S	78.5E	95	0	13	21	33	59		0	0	0	-10	-10	-10				
00032812	11	15.5S	76.1E	100	0	13	13	13	32		0	0	-10	-10	-10					

Statistics for JTWC on TC 21S Hudah																
00032900	12	16.1S	73.9E	90	0	6	32	61	93		0	-5	-5	0	-15	
00032912	13	16.8S	71.4E	95	0	25	59	98	125		0	5	5	-10	-25	
00033000	14	16.9S	68.9E	90	0	6	21	26	44		0	10	-5	-20	-45	
00033012	15	17.0S	66.5E	80	6	18	17	29	37		0	-10	-25	-50	-60	
00033100	16	17.0S	64.3E	90	0	13	18	31	53		-10	-10	-30	-40	-45	
00033112	17	17.0S	61.8E	100	0	12	21	25	57		0	-20	-25	-30	-35	
00040100	18	17.0S	59.4E	120	0	19	31	51	63		0	0	-5	-10	15	
00040112	19	16.6S	56.9E	125	0	0	21	26	47		0	5	10	10	25	
00040200	20	16.2S	54.4E	125	0	13	41	59	67		0	5	15	20	45	
00040212	21	15.4S	51.6E	125	6	31	58	57	33		0	15	20	45	35	
00040300	22	14.9S	49.0E	100	29	65	75	80	138		0	5	35	35	25	
00040312	23	14.8S	46.5E	70	21	25	57	73	128		0	30	30	30	40	
00040400	24	15.2S	44.2E	45	18	60	34	58	135		0	0	0	10	-15	
00040412	25	15.3S	42.3E	55	0	38	53	92	166		0	0	-5	-20	-40	
00040500	26	16.5S	41.0E	65	0	29	97	160	216		0	10	20	-15	-55	
00040512	27	17.1S	39.8E	65	13	52	70	100	127		0	5	20	-10	-50	
00040600	28	17.5S	39.4E	70	6	11	40	89	152		0	5	-10	-15	-40	
00040612	29	18.6S	38.7E	70	16	29	87	186	342		0	-15	-20	-15	-10	
00040618	30	18.9S	38.6E	90	8	59	136	249	373		0	0	0	10	25	
00040700	31	19.0S	38.4E	90	0	59	136	213	299		0	0	0	15	15	
00040706	32	18.8S	38.3E	100	5	34	101	179	241		0	5	30	60	60	
00040712	33	18.6S	38.3E	100	5	54	138	230	278		0	15	35	65	50	
00040718	34	18.3S	38.5E	100	0	57	108	163			0	20	45	70		
00040800	35	18.0S	38.4E	90	0	54	121	162			5	15	40	20		
00040806	36	17.2S	38.3E	80	0	30	67				0	5	15			
00040812	37	16.7S	38.4E	70	6	42	36				0	15	5			
00040818	38	16.1S	38.5E	55	0	6					0	-5				
00040900	39	15.3S	38.6E	35	5	42					0	0				
00040906	40	15.0S	38.5E	30	0						0					
00040912		14.4S	38.2E	25												
		AVERAGE		5	30	57	91	127	145		0	8	18	24	31	32
		BIAS									0	2	3	0	-10	-32
		# CASES		40	39	37	35	33	3		40	39	37	35	33	3

Statistics for JTWC on TC 22P Tessi																				
DTG	NO.	WRN BEST TRACK		POSITION ERRORS						WIND ERRORS										
		LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00033100		14.2S	155.4E	20																
00033106		14.6S	155.0E	20																
00033112		15.0S	154.4E	25																
00033118		15.3S	153.7E	25																
00040100	1	15.6S	153.1E	35	0	29	64	84	57		0	0	5	5	15					
00040112	2	16.5S	151.8E	40	21	96	161	163			0	0	5	25						
00040200	3	17.8S	150.0E	45	0	23	37				0	0	0	15						
00040212	4	18.8S	147.8E	50	16	13					-5	10								
00040300	5	18.9S	146.0E	30	12						0									
00040306		19.0S	145.6E	25																
		AVERAGE		10	40	88	123	57			1	3	8	15	15					
		BIAS									-1	3	8	15	15					
		# CASES		5	4	3	2	1			5	4	3	2	1					

Statistics for JTWC on TC 23P Vaughan																				
WRN BEST TRACK				POSITION ERRORS							WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00033100		20.5S	167.7E	25																
00033106		20.1S	167.2E	25																
00033112		19.9S	167.1E	25																
00033118		19.7S	167.2E	25																
00040100		18.3S	166.5E	25																
00040106		17.9S	166.0E	25																
00040112		17.6S	165.2E	25																
00040118		17.3S	164.1E	25																
00040200		17.2S	162.8E	25																
00040206		16.7S	161.9E	25																
00040212		16.3S	160.8E	25																
00040218		15.3S	160.3E	25																
00040300	1	14.5S	159.4E	35	8	64	63	56	44				0	5	0	10	20			
00040312	2	14.2S	157.1E	35	11	37	63	26	70				0	-10	5	15	25			
00040400	3	13.6S	155.0E	50	0	17	55	84	78				5	15	25	35	35			
00040412	4	13.2S	152.6E	45	5	79	75	67	103				0	10	20	25	45			
00040500	5	14.0S	151.4E	40	26	37	12	46	96				0	10	10	25	25			
00040512	6	14.7S	149.7E	35	32	68	63	59					0	-5	15	40				
00040600	7	15.3S	147.4E	40	5	31	84						0	15	20					
00040612	8	16.1S	146.2E	30	32	54							5	15						
00040700	9	16.7S	145.4E	15	93								10							
		AVERAGE				24	48	59	56	78			2	11	14	25	30			
		BIAS											2	7	14	25	30			
		# CASES				9	8	7	6	5			9	8	7	6	5			

Statistics for JTWC on TC 24S Paul																				
WRN BEST TRACK				POSITION ERRORS							WIND ERRORS									
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00041100		13.1S	127.4E	20																
00041106		12.9S	125.6E	25																
00041112		13.0S	124.4E	25																
00041118		13.2S	122.9E	25																
00041200		13.3S	120.8E	25																
00041206		13.0S	118.9E	25																
00041212		12.9S	117.4E	25																
00041218		13.1S	115.9E	30																
00041300	1	13.8S	114.3E	30	6	24	54	107	138				0	-5	-25	-50	-65			
00041312	2	14.5S	111.6E	40	6	0	13	13	42				0	-15	-40	-60	-70			
00041400	3	14.9S	109.0E	60	13	31	54	76	105				-5	-30	-45	-60	-55			
00041412	4	15.0S	107.0E	90	0	42	78	102	110				0	-15	-25	-15	-15			
00041500	5	14.5S	104.9E	110	0	18	21	50	88				0	-10	-5	-10	-10			
00041512	6	13.9S	102.8E	125	0	17	50	89	125				0	0	-5	-5	-5			
00041600	7	13.7S	100.9E	125	13	13	17	59	136				0	0	0	0	5			
00041612	8	13.8S	99.4E	125	8	8	23	93	174				0	5	5	10	15			
00041700	9	14.0S	98.0E	120	18	17	48	134	215				0	0	5	15	20			
00041712	10	14.3S	96.7E	115	8	23	117	175	238				0	-5	5	5	25			
00041800	11	14.6S	96.1E	105	13	81	137	206	253				0	5	5	25	30			
00041812	12	14.6S	95.7E	95	29	70	128	169	203				0	5	25	35	40			
00041900	13	14.7S	95.3E	90	21	54	81	94	110				0	20	20	25	30			

Statistics for JTWC on TC 24S Paul														
00041912	14	14.7S	95.1E	65	17	18	8	6	26	0	0	0	0	-5
00042000	15	14.7S	94.6E	55	13	30	41	87		0	5	10	0	
00042012	16	14.9S	93.8E	45	0	0	24			0	5	0		
00042100	17	15.1S	93.0E	35	8	8				0	0			
00042112	18	15.3S	91.6E	35	28					0				
00042118		15.4S	90.9E	25										
		AVERAGE		11	27	56	97	140		0	7	14	21	28
		BIAS								0	-2	-4	-6	-4
		# CASES		18	17	16	15	14		18	17	16	15	14

Statistics for JTWC on TC 25P Neil																				
WRN BEST TRACK				POSITION ERRORS						WIND ERRORS										
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00041406		18.2S	179.9W	25																
00041412		18.5S	179.8E	25																
00041418		18.7S	179.5E	25																
00041500		19.0S	179.3E	25																
00041506		19.4S	179.1E	25																
00041512	1	19.9S	179.0E	40	23	8	66	168					0	5	5	0				
00041518	2	20.4S	179.0E	40	18	62	133	251					0	5	5	5				
00041600	3	21.0S	179.0E	40	50	68	183						0	5	5					
00041606	4	21.8S	179.2E	40	44	89	214						0	5	10					
00041612	5	22.5S	179.5E	35	21	100							0	0						
00041618	6	23.0S	179.8W	35	64	186							0	5						
00041700	7	23.3S	178.8W	30	24								0							
00041706		23.7S	177.8W	25																
		AVERAGE		36	86	149	210						0	4	6	3				
		BIAS											0	4	6	3				
		# CASES		7	6	4	2						7	6	4	2				

Statistics for JTWC on TC 26S Innocente																				
WRN BEST TRACK				POSITION ERRORS						WIND ERRORS										
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00041506		14.4S	81.9E	25																
00041512		14.7S	80.9E	25																
00041518	1	15.0S	80.1E	35	11	39	101	140	173				0	10	15	20	15			
00041606	2	15.5S	78.7E	35	13	65	104	116	151				0	10	15	10	15			
00041618	3	15.7S	77.7E	35	60	107	149	185	226				0	5	0	10	25			
00041706	4	16.2S	76.5E	35	21	38	38	48	66				0	-5	0	15	30			
00041718	5	16.8S	75.0E	45	5	17	38	66	90				0	0	15	25	35			
00041806	6	17.1S	73.5E	45	11	6	6	6	46				0	10	20	30	35			
00041818	7	17.5S	71.9E	35	0	27	21	38	134				0	5	10	5	5			
00041906	8	18.0S	70.3E	30	0	13							0	-5						
00041912		18.3S	69.5E	25																
00041918		18.4S	68.8E	25																
00042000		18.4S	68.1E	25																
00042006		18.2S	67.4E	25																
00042012		18.0S	66.7E	25																
00042018		17.8S	66.0E	25																
00042100		17.6S	65.3E	25																

Statistics for JTWC on TC 26S Innocente														
AVERAGE			15	39	65	86	127		0	6	11	16	23	
BIAS									0	4	11	16	23	
# CASES			8	8	7	7	7		8	8	7	7	7	

Statistics for JTWC on TC 27S Rosita																				
WRN BEST TRACK			POSITION ERRORS						WIND ERRORS											
DTG	NO.	LAT	LONG	wind	00	12	24	36	48	72	96	120	00	12	24	36	48	72	96	120
00041618		13.1S	119.9E	30																
00041700		13.5S	119.8E	30																
00041706	1	13.9S	119.7E	35	12	42	74	105	162				0	-15	-10	-20	-40			
00041718	2	15.3S	119.1E	50	52	69	106	171	247				0	5	0	-15	-50			
00041806	3	16.5S	119.0E	50	0	23	103	180	252				0	-10	-30	-60	10			
00041818	4	17.3S	119.4E	65	24	86	115	153	246				0	-15	-65	-10	-5			
00041906	5	17.6S	120.6E	90	0	40	125	203					0	-25	10	15				
00041918	6	18.4S	122.3E	125	0	74	164						0	50	15					
00042006	7	19.5S	124.7E	50	0	54							0	0						
00042012		20.2S	126.4E	40																
00042018		20.5S	127.4E	30																
00042100		20.5S	128.4E	30																
		AVERAGE		13	55	114	162	227					0	17	22	24	26			
		BIAS											0	-1	-13	-18	-21			
		# CASES		7	7	6	5	4					7	7	6	5	4			

## 6. APPLIED TROPICAL CYCLONE RESEARCH SUMMARY

Part of the mission of the Joint Typhoon Warning Center is to conduct applied tropical cyclone research as time and resources permit. The purpose of this research is to improve the accuracy of operational forecasts. The following sections summarize the year's applied research projects which were completed or are still in progress.

### 6.1 RIDGE STATISTICS FOR NORTHWEST PACIFIC OCEAN (Cantrell, C. E., NPMOC/JTWC)

JTWC implemented a new forecast track review process for the 2000 western North Pacific Ocean tropical cyclone season that was adapted from the RSMC Tokyo procedures described in their Technical Review #2, JMA March 1998 by Nagata, Tahara and Muroi.

For this statistical review (Table 6-1), JTWC and CLIP forecast positions for TAU 24, 48 and 72 were stratified into four categories according to past 6 hour movement noted on the final best track (see Figure 6-1). As with the RSMC Tokyo procedures, a direction of movement between 180 and 319 degrees indicated that a cyclone was located equatorward of (below) the subtropical ridge. A direction of movement between 010 and 179 degrees defined the cyclone as being located poleward of (above) the subtropical ridge and the direction of movement between 320 and 009 degrees placed the cyclone "on" the subtropical ridge. Another category, "QS" (quasi-stationary), was included to account for cyclones that had a speed of advance of 3 kts or less.

Verification of forecasts in this manner is expected to provide JTWC with a better understanding of forecast biases within the four categories. Preliminary results for the 2000 season indicate a fast bias in the official JTWC forecast when the system was below the ridge (see Figure 6-2a). A similar fast bias is noted in the forecast when the system was above the ridge (see Figure 6-2c). When the system was on the ridge (Figure 6-2b) a westward bias is indicated in the JTWC forecast, indicating that systems recurved sooner than JTWC anticipated.

Table 6-1 summarizes a homogeneous comparision between JTWC and CLIP for tropical cyclones in 2000 with respect to stage of movement. Number of cases are given in parenthesis. % Improvement is defined as  $((\text{CLIP} - \text{JTWC})/\text{CLIP}) * 100$ .

Table 6-1 JTWC and CLIP Forecast Errors (nm) for tropical cyclones in 2000 with respect to stage of movement.						
TIME	FORECAST	BELLOW	ON	ABOVE	QS	ALL
24 Hour	JTWC	72 (268)	82 (124)	93 (161)	87 (54)	81 (607)
	CLIP	95 (268)	120 (124)	127 (161)	111 (54)	110 (607)
	% Improve- ment	24	32	27	22	26
48 Hour	JTWC	132 (223)	138 (95)	164 (108)	152 (44)	142 (470)

Table 6-1 JTWC and CLIP Forecast Errors (nm) for tropical cyclones in 2000 with respect to stage of movement.						
	CLIP	200 (223)	256 (95)	280 (108)	192 (44)	229 (470)
	% Improvement	34	46	41	21	38
72 Hour	JTWC	202 (197)	202 (65)	205 (71)	271 (33)	209 (366)
	CLIP	327 (197)	384 (65)	400 (71)	311 (33)	350 (366)
	% Improvement	38	47	49	13	40

## 6.2 BETA-TEST OF THE SYSTEMATIC APPROACH TO TROPICAL CYCLONE FORECASTING AID (SAFA) (Jeffries R. and Cantrell, C. E., NPMOC/JTWC)

The Joint Typhoon Warning Center (JTWC) conducted the first full operational beta-test of the Systematic Approach to Tropical Cyclone Forecasting Aid (SAFA), developed by Dr. Les Carr III, Naval Post Graduate School, Monterey, California, during the 2000 western North Pacific tropical cyclone season. SAFA is a computer based tropical cyclone (TC) forecast system designed to aid the Typhoon Duty Officer (TDO) in the review of model fields and in identifying possible systematic model errors.

Two forecast aids, the Non-Selective Consensus (NCON) and the Selective Consensus (SCON), are created by SAFA in conjunction with a model field review by the TDO. The NCON is a simple numerical consensus of all available dynamic model vortex tracks for each warning. The five models considered for the NCON are the Navy Operational Global Atmospheric Prediction System (NOGAPS), Geophysical Fluid Dynamics Laboratory Hurricane Prediction System - Navy version (GFDN), U.K. Met Office global model (EGRR), Japan Global Spectral Model (JGSM), and the Japan Typhoon Model (JTYS). If the TDO determines, after a thorough field review, that one or more of the models contains an error they have the option of removing that model(s) from the NCON thus creating an SCON.

A homogeneous comparison of the 24, 48 and 72-hour track errors for the JTWC official forecast, NCON, and SCON was conducted. However, only the 72-hour errors are discussed here. JTWC, NCON, and SCON track errors for 348 cases are presented in Figure 6-4.

Findings suggest that JTWC added value over NCON and SCON at 72 hours when NCON consisted of three or less models. However, JTWC was not able to add value to NCON when NCON consisted of 4 and 5 models. Figure 6-4 also highlights the fact that as the number of models available for NCON increases, the NCON track error decreases, especially once the fourth model is added. When all cases with one or more models are considered, the difference between JTWC and NCON is statistically insignificant.

Another important finding of this study centers around the creation of SCON. SCON was unable to improve on NCON when four and five models were available. Statistics also show that JTWC followed SCON closely in the four and five model cases. This points to the fact that SCON predictions were created too frequently, which in turn degraded the JTWC forecast when four and five models were available.

The initial test of SAFA was successful at JTWC, as the SAFA field review contributed to improved JTWC forecasts. This analysis, however, identified weaknesses in the initial user training and overall application of SAFA. Attention to these areas should result in JTWC being able to fully exploit the capabilities of SAFA as a method to continue improving TC track forecasts.

A more detailed review of the SAFA beta test at JTWC is being submitted to the AMS for publication in Weather and Forecasting.

### 6.3 JTWC OFFICIAL FORECAST AND MODEL INTENSITY STUDY (Jeffries R., Cox A.W., and Mallen K., NPMOC/JTWC)

JTWC implemented a program to baseline forecast errors as a starting point to future studies into the factors affecting intensity forecasting skill. The official forecast intensity errors were compared to the Statistical Typhoon Intensity Forecast (STIFOR) model intensity errors for the 2000 western North Pacific tropical cyclone season. Figure 6-5 displays the distribution and relative frequency of errors at the 24, 48 and 72-hour forecast.

Additionally, JTWC compared the submitted "bogus" intensity to the model initialization intensity for both the NOGAPS model and the GFDN model. It is noted that GFDN initializes close to the JTWC submitted intensity (Figure 6-6) in many instances, but the NOGAPS model appears to frequently

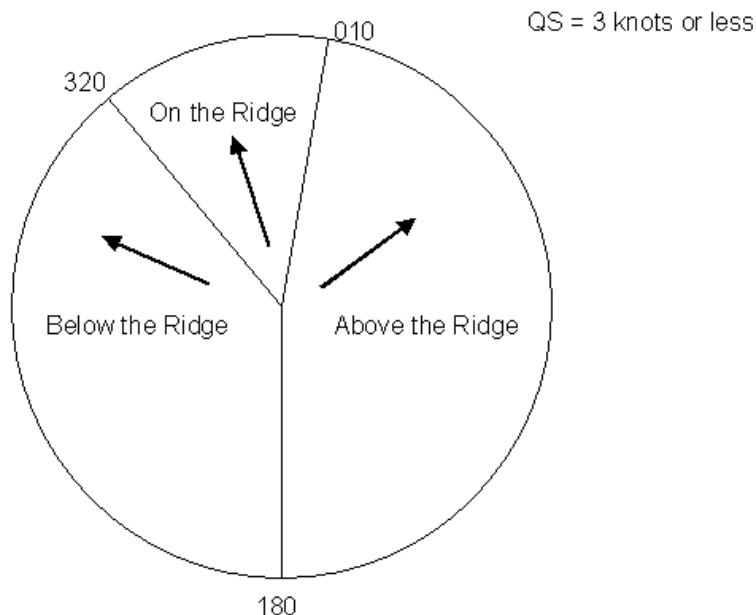


Figure 6-1. Graphical illustration of "Below", "On", "Above", and "QS". "Below" means that the direction of TC movement measured clockwise from the north is 180 to 319 degrees, "On" is 320 - 009 degrees, and "Above" is 010 to 179 degrees respectfully. A fourth category "QS" is included to account for systems that are quasi-stationary (speed of advance of 3 knots or less).

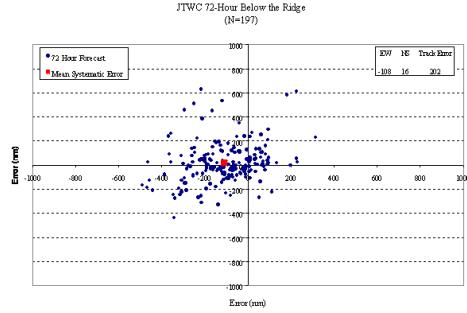


Figure 6-2a. Scatter diagram of center position errors of JTWC official forecasts at 72-hours for tropical cyclones (TC) in the western North Pacific during the 2000 season when the TC was below the ridge. Predicted TC centers are plotted in blue with respect to corresponding analyzed ones at the origin. Deviations upward (downward, leftward, rightward) from the origin indicate the predicted TC center is located north (south, east, west) of the analyzed one. The larger red square shows the mean (systematic) error, which is specified in nautical miles at the upper right hand corner of the graph. "EW" denotes the mean error in the "zonal" direction, "NS" denotes the mean error in the "meridional" direction, while track error is the mean track error.

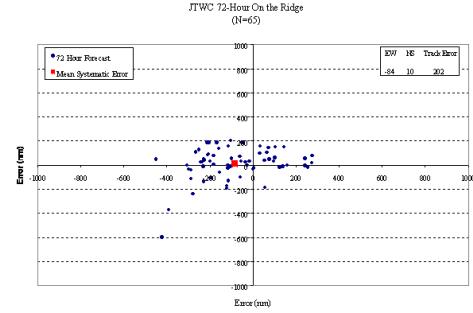


Figure 6-2b. Same as in Fig. 6-2a. except on the ridge.

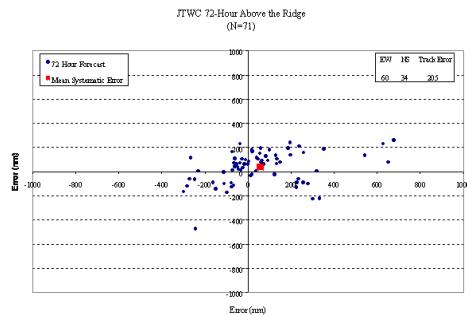


Figure 6-2c. Same as in Fig. 6-2a. except above the ridge.

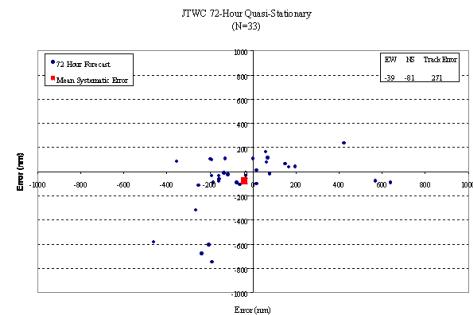


Figure 6-2d. Same as in Fig. 6-2a. except quasi-stationary.

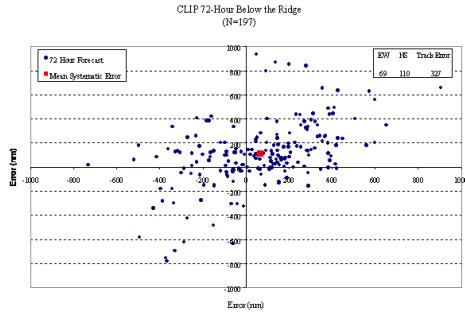


Figure 6-3a. Scatter diagram of center position errors of CLIP official forecasts at 72-hours for tropical cyclones (TC) in the western North Pacific during the 2000 season when the TC was below the ridge. Predicted TC centers are plotted in blue with respect to corresponding analyzed ones at the origin. Deviations upward (downward, leftward, rightward) from the origin indicate the predicted TC center is located north (south, east, west) of the analyzed one. The larger red square shows the mean (systematic) error, which is specified in nautical miles at the upper right hand corner of the graph. "EW" denotes the mean error in the "zonal" direction, "NS" denotes the mean error in the "meridional" direction, while track error is the mean track error.

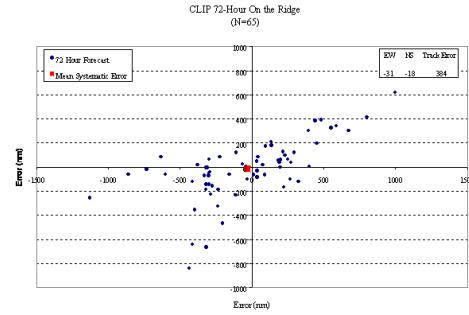


Figure 6-3b. Same as in Fig. 6-3a. except on the ridge.

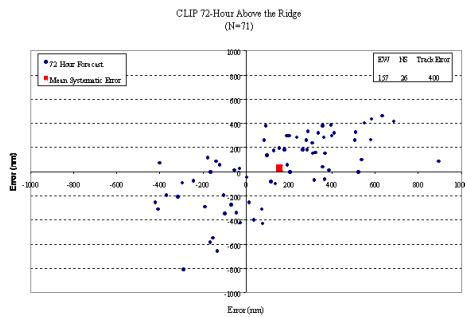


Figure 6-3c. Same as in Fig. 6-3a. except above the ridge.

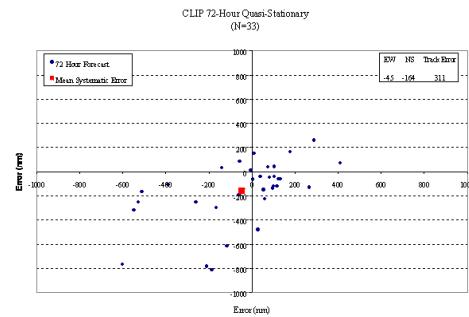


Figure 6-3d. Same as in Fig. 6-3a. except quasi-stationary.

under-represent the initial intensity, particularly in more intense systems (Figure 6-7). JTWC will continue to investigate and research the factors affecting intensity forecasting.

## 6.4 JTWC STORM ARCHIVE (LaFramboise D., Herron J., Schiber D. and Cantrell C., NPMOC/JTWC)

Storm reviews of the 34 western North Pacific storms that occurred during the 2000 tropical cyclone season have been created as part of the newly developed JTWC archive site. Each review includes all data available to JTWC during the time individual storms were being warned on. The archive site includes satellite data (AMSU, TRMM, SSMI, and Scatterometer), graphical displays of objective techniques and dynamic model vortex trackers, synoptic data, time intensity charts, warning graphics, warning messages, fix bulletins, and the objective techniques, best track and fix files from the Automated Tropical Cyclone Forecasting (ATCF) system. Each storm review also contains a 3-hourly satellite loop depicting the storm's life-cycle through infrared imagery. This data base will be continued for the 2001 Southern Hemisphere and Northern Hemisphere seasons and will be updated on a routine basis.

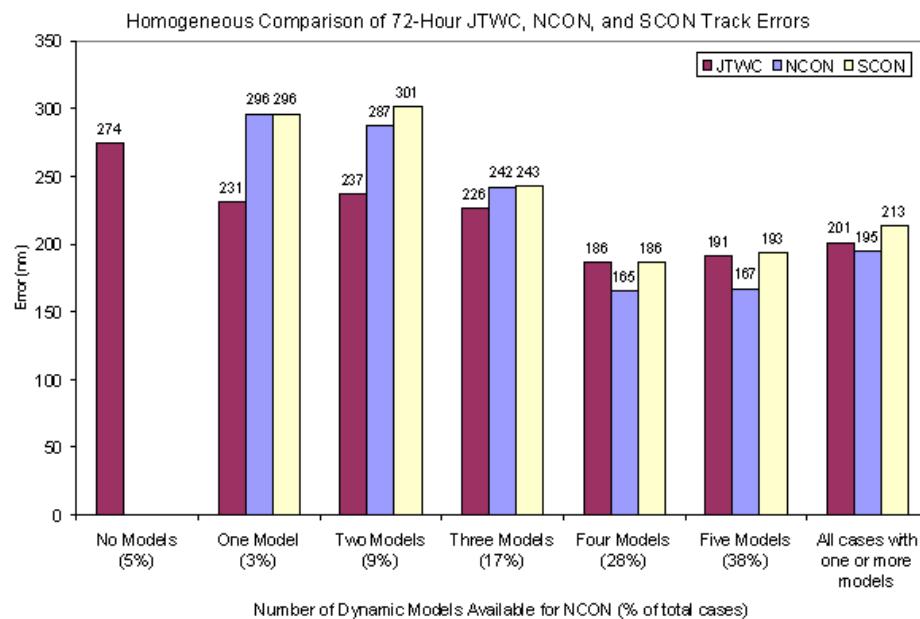


Figure 6-4. Homogeneous comparison of 72-hour mean forecast errors (NM) for JTWC, NCON, and SCON. Errors are categorized according to the number of models NCON contains.

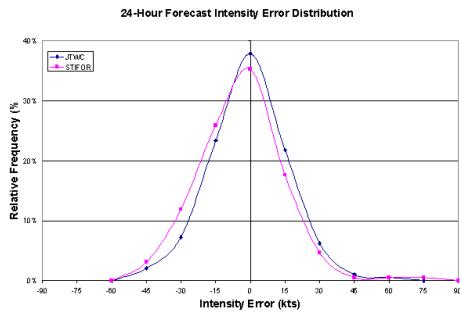


Figure 6-5a. The intensity error distribution and frequency for the 24-hour official JTWC forecast and the STIFOR model during the 2000 western North Pacific tropical cyclone season.

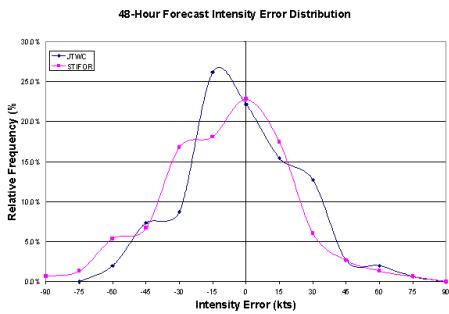


Figure 6-5b. The intensity error distribution and frequency for the 48-hour official JTWC forecast and the STIFOR model during the 2000 western North Pacific tropical cyclone season.

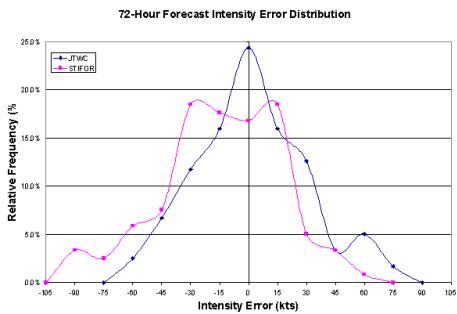


Figure 6-5c. The intensity error distribution and frequency for the 72-hour official JTWC forecast and the STIFOR model during the 2000 western North Pacific tropical cyclone season.

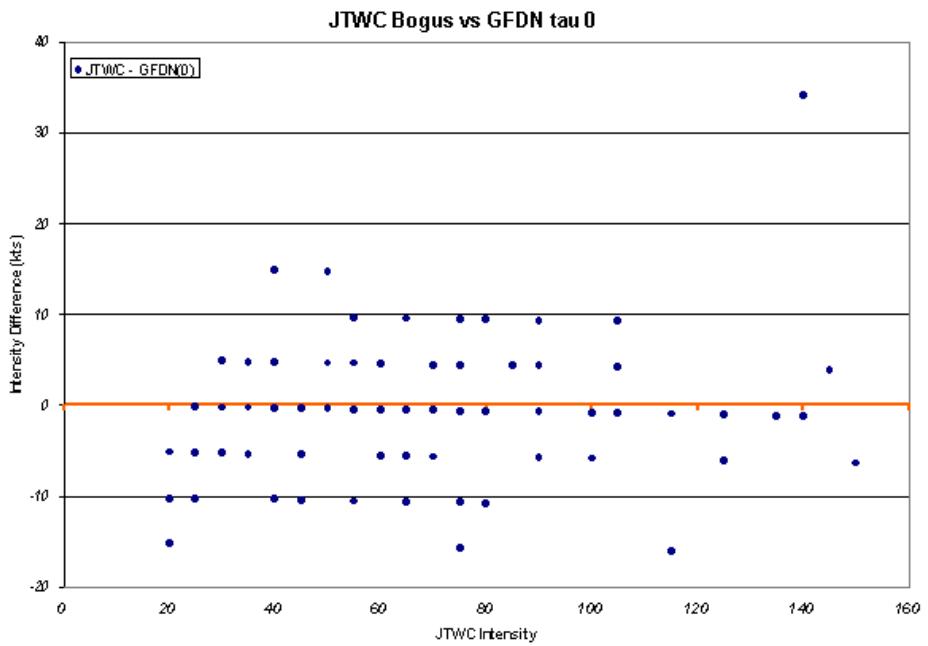


Figure 6-6. Intensity difference between the submitted JTWC intensity and the GFDN analysis.

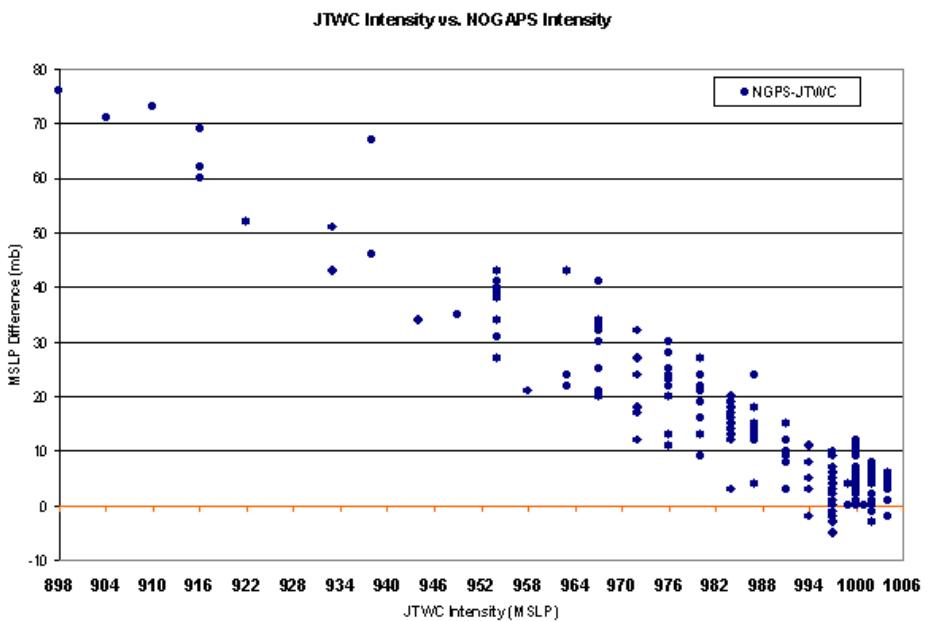


Figure 6-7. Intensity difference between the submitted JTWC intensity and the NOGAPS analysis.

A data base of all available GOES-10, GMS-5 and MET-5 full disk visible, infrared, and water vapor imagery for all of 2000 and 2001 (year-to-date) has also been included as part of the archive. This data base is updated continuously.

The final section of the archive includes 6-hourly surface synoptic charts and 12-hourly upper air charts for 2000 and will also be updated on a continuous basis.

Access to this site will be granted on a case-by-case basis. Please contact the JTWC technical advisor at [JTWCTA@npmoc.navy.mil](mailto:JTWCTA@npmoc.navy.mil).

## **6.5 VALIDATION OF BEST TRACK DATA (Chu J. and Sampson B., NRL; Fukada,E. Schiber D. and Levine A., NPMOC/JTWC)**

A systematic cross-validation of the western North Pacific (1950-1998), the north Indian Ocean (1970-1998) and the Southern Hemisphere (1985-1998) best track data contained in the JTWC archive database and Annual Tropical Cyclone Reports (ATCR) is being performed to eliminate errors noted in previous years and ensure the archive better represents the published best-tracks.

The team will visually compare and document differences between JTWC archive data and JTWC ATCRs, check best-tracks against other sources, such as the Hong-Kong Observatory, and Charlie Neumanns HURISK program (published in 24th Conference on Hurricanes and Tropical Meteorology), agree to changes in the archive, and include the final corrections into the JTWC archive database.

The final step will be a posting of the corrections to the JTWC web site and into the ATCF system database. A written report will serve as documentation of the results.